



**TETRA TECH**

**Supplemental AOC Characterization Report  
AOC 1 and 2  
Pre-1990 Area**

**Formosa Plastics Corporation - Texas**

**August 30, 2013**

complex world

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August 29, 2013

Via e-mail and Certified Mail:  
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RE: Supplemental Areas of Concern Characterization Report  
RCRA Docket No. VI-001(h)-90-H  
3008(h) Administrative Order on Consent  
EPA I. D. No. TXT490011293  
Solid Waste Registration No. 31945

Dear Ms. Fagan:

Please find attached the Supplemental Areas of Concern (AOC) Characterization Report. This report summarizes the data from the supplemental AOC characterization field work conducted in June 2013. This document is being submitted as required by Amendment No. 2 to the 3008(h) Order, TASK XI: Corrective Measures Implementation Program.

If you have any questions about this report, please contact Matt Brogger at (361) 987- 7468 or by e-mail at [mattb@fpc.fpcusa.com](mailto:mattb@fpc.fpcusa.com).

Sincerely

R. P. Smith  
Vice President/General Manager  
Formosa Plastics Corporation, Texas

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**Supplemental AOC Characterization Report  
AOC 1 and 2  
Pre-1990 Area  
Formosa Plastics Corporation - Texas**

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August 30, 2013

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## LIST OF ACRONYMS

AOC	Area of Concern
CAO	Corrective Action Objective
CAP	Corrective Action Plan
COC	Chemical of Concern
COPC	Chemical of Potential Concern
C-O-C	Chain-of-Custody
C <sub>sat</sub>	Soil Saturation Limit
DQO	Data Quality Objectives
EDC	1,2-Dichloroethane or Ethylene Dichloride
EPA	U.S. Environmental Protection Agency
FM	Farm to Market Road
FPC-TX	Formosa Plastics Corporation, Texas
FSP	Field Sampling Plan
HASP	Health and Safety Plan
NAPL	Non-Aqueous Phase Liquid
NFA	No Further Action
PCE	Tetrachloroethene
PCL	Protective Concentration Level
PVC	Polyvinyl Chloride
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RMP	Risk Management Plan
SWMU	Solid Waste Management Unit
TCE	Trichloroethene
TCEQ	Texas Commission on Environmental Quality
TDS	Total Dissolved Solids
TRRP	Texas Risk Reduction Program
VCM	Vinyl Chloride Monomer
VOC	Volatile Organic Compounds
WWTP	Waste Water Treatment Plant
1,1-DCA	1,1-dichloroethane
1,1-DCE	1,1-dichloroethene

## 1.0 INTRODUCTION

In accordance with the U.S. Environmental Protection Agency (EPA) Administrative Order on Consent with Corrective Action Plan (CAP) dated February 27, 1991, as amended on June 12, 2012 (Amendment No. 2) (EPA Docket No. VI-001(h)-90-H; EPA I.D. No. TXT490011293), Formosa Plastics Corporation, Texas (FPC-TX) has undertaken measures to characterize and remediate soil and groundwater affected by volatile organic compounds (VOCs) at the Point Comfort facility.

As documented in the Final Risk Management Plan (RMP) (Tetra Tech, 2010), impacted soil and groundwater associated with Solid Waste Management Units (SWMUs) have been segregated into two distinct Areas of Concern (AOC) at the FPC-TX facility: AOC 1 – the former Waste Water Treatment Plant (WWTP) area located in the eastern portion of the pre-1990 area; and AOC 2 – the Vinyl Chloride Monomer (VCM) Process area located in the central portion of the pre-1990 area. Amendment No. 2 to the 3008(h) Administrative Order includes requirements for additional characterization of the two pre-1990 area AOCs. The Final AOC Characterization Work Plan (Tetra Tech, 2012) was submitted to EPA on May 4, 2012 and approved by EPA on June 12, 2012. The work plan was implemented and the AOC Characterization Report (PBW, 2012) was submitted to EPA on November 9, 2012.

Corrective Action Objectives (CAOs) were presented in EPA's Performance Based Remedy Decision document (EPA, 2009), finalized in the Response to Comments/Final Decision Document (EPA, 2010) and discussed in detail in the RMP and the Final AOC Characterization Work Plan. The Final AOC Characterization Work Plan developed Data Quality Objectives (DQOs) (EPA, 2000) for the FPC-TX site to support the Corrective Action Objectives. Based on the data provided in the AOC Characterization Report, and review of additional quarterly monitoring data collected in 2012, it was determined that additional characterization of the two media-based AOCs was required to meet the data quality objectives developed in the Final AOC Characterization Work Plan. Specifically, additional characterization of the extent of impacted groundwater was required to support Corrective Action Objective (CAO) 1 and the groundwater portion of CAO 2.

A Supplemental AOC Characterization Work Plan (the "Supplemental Work Plan") (Tetra Tech, 2013) was prepared that described further characterization activities for both AOCs. The



Supplemental Work Plan was designed as an addendum to the Final AOC Characterization Work Plan and as such relies to a large extent on the Final AOC Characterization Work Plan as well as the AOC Characterization Report. EPA provided comments on the Supplemental Work Plan via e-mail dated January 30, 2013. In addition to the new wells planned in support of CAO 1 and 2, EPA required additional monitoring wells located in the vicinity of existing monitoring wells P-9 and P-38. These additional wells are not required based on the DQOs previously developed; however, additional characterization of the impacted groundwater present at P-9 and P-38 is required to satisfy the requirements of the Affected Property Assessment under the Texas Risk Reduction Program (TRRP).

Following EPA review of a draft and incorporation of EPA's comments, the Supplemental Work Plan was submitted to EPA on February 28, 2013 and approved by EPA on via letter dated March 28, 2013. The investigation was conducted in June 2013 in accordance with the Supplemental AOC Characterization Work Plan. This report presents the findings of the Supplemental AOC Characterization at the FPC-TX facility.

## 2.0 INVESTIGATION ACTIVITIES

Investigation activities were conducted per the approved Supplemental Work Plan and are described in detail in the Supplemental Work Plan. The following activities were conducted during the investigation.

- Installation of seventeen monitoring wells.
- Collection and analysis of groundwater samples from the new monitoring wells.

All groundwater samples collected during the investigation were analyzed for VOCs via EPA Method SW 8260.

Each activity is described in greater detail in the following sections. All activities were conducted in accordance with the Supplemental Work Plan, except where noted. Boring logs and well construction diagrams are included in Appendix A to this report. Survey data for the new wells are included in Appendix B. Groundwater sampling field notes are in Appendix C. The laboratory analytical report (ALS Environmental) is provided in Appendix D. The Data Usability report is in Appendix E.

### 2.1 Monitoring Well Installation

The new monitoring wells were installed using a sonic drilling rig. Monitoring well construction adhered to federal, state and local regulations. With the exception of monitoring well B-1, monitoring wells were constructed of 2-inch diameter, flush-joint threaded stainless steel pipe. Monitoring well B-1 may be converted to a recovery well; thus, it was constructed of 6-inch diameter, flush-joint threaded stainless steel pipe.

For the Zone A wells, first, the sonic rig was located at the surveyed and permitted boring location. Each boring location was checked with a probe rod to four feet bgs in order to locate any underground obstructions or buried piping. Once the location was cleared, a ten-foot long by four-inch diameter core barrel was driven into the ground. This initial run reached a depth of seven feet, as the drilling rig working platform was approximately three feet above ground. This core barrel was removed, and the zero to seven foot sample was extruded from the core barrel.

The override six-inch casing was then driven to the seven foot depth, and the four-inch core barrel was advanced five to ten feet. The core barrel was then retrieved, and the soil core was extruded from the barrel. This process was then repeated one additional time until Zone A was properly identified, at which time the well was set in place. Once the two-inch stainless steel well was constructed, the filter pack placed, and the bentonite chip seal poured, the six-inch override casing was pulled from the borehole. The bentonite seal was hydrated using potable water from the Site.

When drilling boreholes through more than one groundwater bearing unit (i.e. the Zone B and Zone C wells), necessary measures were taken to prevent cross-connection and the potential for cross-contamination between groundwater bearing units. For the Zone B and Zone C wells, the sonic rig was again positioned at the surveyed and permitted boring location, and the location was again probed for underground obstructions. The initial casing run diameter depended on whether the well would ultimately be a Zone B and Zone C well. For the Zone B wells, the initial override casing was a seven-inch. For the Zone C wells, the initial override casing was an eight-inch. In each case, as the four-inch core barrel sampled the soils, the larger casing would override the core barrel, to the sampled depth, and then the core barrel was removed from the borehole and the sample was extruded. The outer, larger casing at the surface would serve to case off the upper A zone, at which time a smaller diameter casing would be advanced into Zone B. If the boring was to become a Zone C well, a third casing would then be advanced after Zone B had been cased off. This creates a telescoping casing downward and effectively serves to eliminate cross-contamination between the groundwater bearing units. At monitoring well B-1, the process was identical to the above description, however, the casing diameters were larger, to accommodate the six-inch diameter stainless steel well screen and riser. Casings at B-1 were a 12-inch, then a ten-inch and then an eight-inch. B-1 was ultimately set in the eight-inch casing.

Once the total depth was determined, the B and C zone wells (with the exception of B-1) were also constructed of two-inch flush-joint stainless steel screen and riser. Occasionally, the borehole was overdrilled, and bentonite chips were used to backfill the borehole to the desired bottom of screen depth. When the screen and riser were set, the filter pack was placed. The annular space around the screened interval was packed with 20/40 mesh washed silica sand to a depth of 2 to 3 feet above the top of the screened interval. A 2- to 5-foot-thick bentonite-pellet seal was poured above the sand filter pack to seal the borehole. The Zone B and Zone C wells

required grouting, to ensure the well's integrity. Above the bentonite seal, a cement-bentonite grout was placed to seal the annular space to within one to three feet below the ground surface. Grouting of the B and Zone C monitoring wells was conducted with a tremie pipe set at the base of the borehole and with the eight-inch or seven-inch surface casings still in the ground. The seven-inch and eight-inch casings were removed as necessary as the grout was pumped from the bottom of the boring to the surface. The grout was allowed to cure for a minimum of 24 hours and then a surface installation was installed (concrete pad, protective steel casing, bollards). A locking, water-tight well plug was placed inside the top of the stainless steel well casing. Following completion, all new wells were developed using a submersible pump.

The following bullets briefly summarize the location of and rationale for each of the new monitoring wells installed. Figure 1 includes the location of all of the existing monitoring and recovery wells and the new monitoring wells.

▪ AOC 1 WWTP Area Groundwater

- Zone A monitoring well P-68 is located to the east of P-18 and to the east of TPZ-AOC1-A4 to support CAO 1 and attempt to bound the extent of the plume to the east of P-18.
- Zone B monitoring well B-1 is located in the vicinity of P-56/P-57/RS-6 to support CAO 1 and CAO 2. This well essentially replaces temporary piezometer TPZ-AOC1-B1 with a permanent well.
- Zone B monitoring well B-2 is located near monitoring well SWM-A1 (P-58) to support CAO 1 and CAO 2 and is intended to adequately characterize the possible extent of the groundwater impacts previously identified at temporary piezometer TPZ-AOC1-B1.
- Zone B monitoring well B-3 is located east of SWMU 7 and east of D-33/D-43 to support CAO 1 and to replace damaged existing well P-16.
- Zone B monitoring well B-4 is located due east of P-56 in the former TxDOT picnic area (property recently acquired by FPC-TX) to support CAO 1 and 2 and is intended to adequately characterize the possible extent of the groundwater impacts previously identified at temporary piezometer TPZ-AOC1-B1.
- Zone C monitoring well D-45 is located in the vicinity of P-56/P-57/RS-6 to monitor for potential vertical contaminant migration to support CAO 1 and CAO 2 and is intended to provide vertical characterization of the groundwater impacts previously identified at temporary piezometer TPZ-AOC1-B1.

- Zone C monitoring well D-46 is located to the west of SWMU 7 to monitor for potential vertical contaminant migration from Zone B wells D-33/D-43 and potential lateral migration from Zone C wells D-34/D-44 to support CAO 1.
- AOC 2 VCM Area Groundwater
  - Zone A monitoring wells P-61 and P-62 are located in the vicinity of SWM-A3 (P-60) to support CAO 1 and are intended to confirm that the COCs previously detected at P-60 are limited in extent.
  - Zone A monitoring well P-66 is located to the west of P-50 to evaluate possible transport pathways from the VCM area plume toward the east in support of CAO 1.
  - Zone B monitoring well B-5 was planned for the vicinity of P-50 in support of CAO 1 to confirm if a Zone B water bearing unit is present at this location: Zone B was not encountered when attempting to set this well, thus B-5 was not installed.
  - Zone B monitoring well B-6 is located on the former Brookings property in support of CAO 1 to confirm that Zone B impacts have not migrated onto the former Brookings property.
  - Zone B monitoring wells B-8 and B-7 are located to the in the vicinity of TPZ-AOC2-B1 and TPZ-AOC2-B2, respectively, to support CAO 1 and 2. These permanent wells essentially replace the previously installed temporary piezometers.
  - Zone C monitoring well D-47 is located approximately 1500 feet southeast of the existing VCM area plume at the southeastern perimeter of the active facility in general support of CAO 1 as well as potentially providing vertical control for the outlier well P-9.
- Outlier Wells P-9 and P-38
  - Zone A monitoring well P-63 is located approximately 400 feet west (downgradient) of P-38 to provide adequate characterization in accordance with TRRP.
  - Zone A monitoring wells P-64 and P-65 are located to the southwest of P-9 to provide additional characterization in accordance with TRRP.

## 2.2 Groundwater Sampling

Groundwater samples were collected via low flow sampling techniques using a peristaltic pump and dedicated polyethylene and silicone tubing. Water levels were measured at each new well prior to sampling and during well purging. Some Zone A wells were slow to recharge and

required additional development prior to sampling. The new wells were sampled June 27 and 28, 2013. Table 1 summarizes the groundwater parameters monitored during well purging and sampling. Groundwater sampling records and field notes are in Appendix C.

All samples were immediately placed into the appropriate containers supplied by the laboratory and immediately placed on ice in ice chests. Samples were kept on ice until shipment to the laboratory. Ice chests were packed with ice and sealed for shipment. Samples were maintained under standard chain-of-custody procedures from the time of collection until receipt by the laboratory.

## 2.3 Well Survey

New monitoring wells were surveyed on July 17, 2013 by Ganem & Kelly Surveying, Inc. Well survey information is located in Appendix B.

## 2.4 Deviations from Work Plan

The following deviations from the Work Plan were made during the course of the investigation:

- 1) Due to the inability of the drilling rig and support box truck to set up exactly at the surveyed location for B-1, the boring location was offset 9 feet to the north and three feet to the west of the location described in the Supplemental AOC Work Plan.
- 2) Due to the relocation of B-1, the boring location for D-45 offset 9 feet to the north of the location described in the Supplemental AOC Work Plan.
- 3) A well was not installed at location B-5 since Zone B was not observed in the subsurface during drilling and the hole was dry.
- 4) Due to the presence of underground utilities, the location for well P-63 was relocated to the opposite side of the road.
- 5) Due to the presence of underground utilities, the location for well B-4 was relocated to the opposite side of State Highway 35, in the former TxDOT picnic area.
- 6) Due to heavy vegetation on the former Brookings property, the location for P-62 was relocated approximately 200' to the southwest.

## 3.0 INVESTIGATION RESULTS

### 3.1 Geology and Hydrogeology

Section 3.1 of the 2012 AOC Characterization Report provided a detailed description of the subsurface geology and stratigraphy at the facility as well as detailed descriptions of the Zone A, B and C water bearing units. The materials and conditions encountered during the Supplemental AOC Characterization investigation are consistent with the information provided in previous reports. Of specific note is the absence of Zone B in the vicinity of existing nested monitoring wells P-50/D-21/3D-3. When considered in conjunction with the lack of Zone B at previous boring location SMW-1BX on the former Brookings Property, this further substantiates the discontinuous nature of Zone B. Updated cross-sections including the new monitoring wells will be prepared and included in the Revised Site-wide Risk Management Plan.

During the initial well sampling event in June, water levels were measured at only the new monitoring wells. During the 3<sup>rd</sup> Quarter 2013 Interim Measures Groundwater Monitoring activities, water levels were measured at all wells located in the pre-1990 area on August 8 and 9, 2013, including the new monitoring wells. Figures 2, 3, and 4 present potentiometric surface maps for Zone A, B, and C groundwater units, respectively.

### 3.2 Groundwater Analytical Results

Groundwater samples were collected from 17 new monitoring wells. The analytical results for groundwater samples are summarized on Table 2. For brevity, Table 2 only includes parameters detected above detection limit. The analytical results associated with the new monitoring wells for Zone A, B, and C are presented on Figures 5, 6 and 7, respectively. These figures only present the data for chemicals of concern with concentrations greater than the Tier 1 groundwater ingestion PCLs. These figures also show the PCLE zone from the 1<sup>st</sup> Quarter 2013 Interim Measures Groundwater Monitoring event. FPC-TX samples all the wells during the 1<sup>st</sup> quarter of each year, thus this data set provides the most temporally cohesive picture of the groundwater impacts each year.

### 3.2.1 AOC 1 WWTP Area Groundwater

Zone A monitoring well P-68: P-68 was installed approximately 250 ft east of the location of TPZ-AOC1-A4, and 350 feet to the east of P-18. The groundwater sample collected at P-68 contained TCE in excess of PCLs. The EDC concentration reported for the sample from P-68 was equal to the PCL. No contaminants were detected in previously sampled piezometer TPZ-AOC1-A5, thus the groundwater plume in this area appears to be migrating directly to the east. The potentiometric surface at P-68 appears to indicate that it is slightly upgradient from P-18. Additional groundwater sampling points may be required in this area to adequately characterize the extent of impacted Zone A groundwater in this area.

Zone B monitoring well B-1: B-1 was installed in the vicinity of P-56/P-57/RS-6 primarily to replace temporary piezometer TPZ-AOC1-B1, as well as provide a potential Zone B recovery well given the elevated concentrations previously reported at TPZ-AOC1-B1. Monitoring well B-1 was located approximately 100 feet east of TPZ-AOC1-B1 in order to locate it relatively close to the existing groundwater recovery infrastructure at the P-56/P-57/RS-6 well grouping. The concentration of several COCs exceeded PCLs in the groundwater sample collected from monitoring well B-1; however the concentration of all COCs are significantly less than those previously reported at TPZ-AOC1-B1. None of the reported concentrations exceeded 1% of the solubility limit.

Zone B monitoring wells B-2, B-3, and B-4: Monitoring well B-2 was installed on the former Brookings property to the south-southeast of monitoring well B-1, near new monitoring well P-58 (formerly SMW-A1), to evaluate the possible lateral extent of the impacted Zone B groundwater. Monitoring well B-3 was installed on the eastern side of the former sludge drying beds (SWMU 7) to evaluate the potential lateral extent of impacted groundwater present at existing monitoring wells D-32/D-33, and to replace damaged monitoring well P-16. Monitoring well B-4 was installed in the former TxDOT picnic area (property recently acquired by FPC-TX) due east of the P-56/P-57/RS-6 well grouping to evaluate the possible lateral extent of the impacted Zone B groundwater. There were no VOC concentrations reported above the PCLs for the groundwater samples collected at B-2, B-3, and B-4.

Zone C monitoring well D-45: D-45 was installed adjacent to new Zone B monitoring well B-1 to monitor for potential vertical contaminant migration associated with TPZ-AOC1-B1. The



concentration of EDC exceeded the PCL in the groundwater sample collected from monitoring well D-45. All other VOC concentrations were reported as less than the detection limit, with the exception of chloroform which was reported at a concentration two orders-of-magnitude below the PCL. The presence of EDC in the sample from D-45 confirms that vertical migration has occurred from Zone B to Zone C in this area. The EDC concentration at D-45 was higher than the EDC concentration reported in the sample from monitoring well B-1. The potentiometric surface of Zone C is extremely flat; however, it does appear that monitoring well D-45 is generally downgradient of the Surge and Emergency Basins.

Zone C monitoring well D-46: D-46 was installed to the east of existing wells D-34/D-44 to provide lateral control of this area and to monitor for potential vertical contaminant migration from Zone B wells D-33/D-43. This well was located in the general vicinity of existing Zone B wells D-33 and D-43. All VOC concentrations in the groundwater sample collected from monitoring well D-46 were reported as less than the detection limit with the exception of chloroform, which was reported at a concentration two orders-of-magnitude below the PCL.

### **3.2.2 AOC 2 VCM Area Groundwater**

Zone A monitoring wells P-61 and P-62: P-61 and P-62 were installed on the former Brookings property to the east and south of P-60 (formerly SWM-A3) to attempt to characterize the potential lateral extent of impacted Zone A groundwater in this area. There were no VOC concentrations reported above the PCLs for the groundwater samples collected at monitoring wells P-61 and P-62.

Zone A monitoring well P-66: P-66 was installed along the property boundary between P-50 and P-3 to further evaluate the extent of impacted Zone A groundwater in this area and evaluate possible transport pathways from the VCM area plume in support of CAO 1. EDC was detected in monitoring wells P-50 and P-51 during the 4<sup>th</sup> quarter 2012 and the 1<sup>st</sup> and 2<sup>nd</sup> quarter 2013 groundwater monitoring events, albeit at concentrations less than PCLs. All VOC concentrations in the groundwater sample collected from monitoring well P-66 were reported as less than the detection limit with the exception of chloroform, which was reported at a concentration approximately one order-of-magnitude below the PCL.

Zone B proposed monitoring well B-5: B-5 was intended to be installed in the vicinity of P-50 in support of CAO 1; however, Zone B was not found in the subsurface at the B-5 location, thus no well was installed, and no groundwater sample collected at this location. The absence of Zone B in this area confirms that existing monitoring well D-21 is a C Zone well. Cross-sections will be modified in the next update of the RMP to reflect the better understanding of the B and C Zone in this area.

Zone B monitoring well B-6: B-6 was installed on the former Brookings property in support of CAO 1 and was intended to serve several purposes including: evaluating the potential extent of the Zone B discontinuity observed when previously attempting to install a Zone B well on the former Brookings property south of RS-4/RS-5 near monitoring P-60; providing an off-site Zone-B monitoring point approximately mid-way between the VCM and former WWTP groundwater areas; and obtaining valuable additional geological and potentiometric data from this location. Zone B was encountered at this location, thus the discontinuity observed at previous location SMW-B1X and proposed location B-5 does not extend to this area. There were no VOC concentrations reported above the PCLs for the groundwater sample collected at monitoring well B-6. EDC was reported at a concentration of 0.003 mg/l, slightly below the PCL of 0.005 mg/l. The potentiometric surface for monitoring well B-6 appears to be generally downgradient of the facility. Future sampling of this well will confirm if contamination is present in Zone B on the former Brookings property.

Zone B monitoring wells B-8 and B-7: Monitoring wells B-7 and B-8 were installed to the south of TPZ-AOC2-B1 and southeast of TPZ-AOC2-B2, respectively, to support CAO 1 and 2 and replace those temporary piezometers. COC concentrations in excess of PCLs were previously reported for the groundwater samples collected at both temporary piezometer locations. The new wells provide key monitoring point locations as well as providing potentiometric surface data so that Zone B hydrogeologic characteristics will be better understood.

The concentrations reported for the sample collected at monitoring well B-7 exceed the PCLs for several COCs, and are similar, but slightly less than those reported for the sample previously obtained at TPZ-AOC2-B2. Temporary well TPZ-AOC2-B2 was screened at a depth of 39 to 44 feet below grade. Monitoring well B-7 was screened at a depth of 30 to 40 feet below grade. Monitoring well B-7 is located approximately 67 feet to the southeast of TPZ-AOC2-B2. Based on the potentiometric surface, monitoring well B-7 appears to be downgradient of the VCM area.

Monitoring well B-8 is located approximately 128 feet south of TPZ-AOC2-B1. TPZ-AOC2-B1 was screened at a depth of 37 to 42 feet. New monitoring well B-8 was screened at a depth of 33 to 43 feet. The concentrations reported for the sample previously obtained at TPZ-AOC2-B1 were very high with several COC concentrations approaching 1% of the solubility limit. There were no VOC concentrations reported above the PCLs for the groundwater sample collected at monitoring well B-8. It is possible that Zone B is not continuous between B-8 and TPZ-AOC2-B1. The potentiometric surface at B-8 indicates it is upgradient from both existing well P-12 and new monitoring well B-7. Based on the results reported for the sample from monitoring well B-8, the southern extent of the Zone B contaminant plume appears to be bounded. Further, monitoring well B-8 is located in the general vicinity of Zone A wells P-3 and RS-4/RS-5, and appears to indicate there is no vertical migration of contaminants from Zone A in this area.

Zone C monitoring well D-47: D-47 was installed approximately 1350 feet southeast (downgradient) of existing recovery well RD-1 at the southeastern perimeter of the active facility in general support of CAO 1 as well as potentially providing vertical control for the outlier well P-9. There were no VOC concentrations reported above the PCLs for the groundwater sample collected at monitoring well D-47.

### 3.2.3 Outlier Wells P-9 and P-38

Zone A monitoring well P-63: P-63 was installed downgradient of P-38 to provide additional characterization of this area in accordance with TRRP. There were no VOC concentrations reported above the detection limit for the groundwater sample collected at monitoring well P-63.

Zone A monitoring wells P-64 and P-65: P-64 and P-65 were installed to the southwest of P-9 to provide additional characterization of this area in accordance with TRRP as well as provide additional Zone A monitoring well located along the property boundary north of the Alcoa mud lakes. There were no VOC concentrations reported above the PCLs for the groundwater samples collected at monitoring wells P-63 and P-65. The potentiometric surface at monitoring wells P-64 and P-65 are of interest (Figure 2). Previously the elevated potentiometric surface at P-9 was interpreted to possibly be associated with mounding caused by the mud lakes. Based on the most recent data, neither P-65 (which is actually closer to the mud lakes) nor P-64

indicate elevated water levels. The high elevation at monitoring well P-9 may be a localized high area, or the high point associated with a natural groundwater divide.

### **3.3 Data Usability**

A QA/QC data validation review was performed to evaluate the level of accuracy, precision, and completeness of the laboratory data. Table 3 presents VOC analytical results for field duplicates and VOC analytical results for trip blanks and field blanks are presented in Table 4. The Data Usability Summary (DUS) is provided in Appendix E. Results were evaluated based on TRRP criteria and all reported results were determined to be valid and usable for the purposes intended by this report. The reviewer qualified some results as potentially contaminated (U), and/or not accredited (X7). The qualifications affect samples collected at eight wells (P-62, P-63, P-65, P-66, P-68, B-4, B-8, and D-47) for acetone due to field blank contamination. Data qualifications are presented in Table 2 and included in the DUS in Appendix E.

## 4.0 SUMMARY AND CONCLUSIONS

The Zone A plume observed at well P-18 and TPZ-AOC1-A4 extends to the east at least as far as the location of new monitoring well P-68. No contaminants were detected in previously sampled piezometer TPZ-AOC1-A5 located to the south of P-68, thus the groundwater plume in this area appears to be migrating directly to the east. Additional monitoring points may be required to adequately characterize Zone A in this area.

Concentrations of EDC and other COCs in Zone B monitoring well B-1 exceeded PCLs, but were lower than anticipated given the elevated concentrations previously reported in TPZ-AOC1-B1, located nearby. This, coupled with the presence of EDC above the PCL in the groundwater sample collected at Zone C well D-45, may indicate that Zone B in this area is more likely to represent a vertical conduit between Zone A and Zone C as opposed to extensive lateral migration in Zone B.

There were no VOC concentrations reported above the detection limit for the groundwater samples collected at monitoring wells B-2, B-3, B-4, and B-6. The impacted Zone B groundwater identified at TPZ-AOC1-B1 and new monitoring well B-1 appears to be adequately characterized. However, it was noted that the concentration of EDC reported for the sample collected at monitoring well B-6 on the former Brookings Property was only slightly below the PCL. Future sampling of the well should be closely reviewed.

The concentration of EDC exceeded the PCL in the groundwater sample collected from Zone C monitoring well D-45. Additional monitoring points may be required to adequately characterize Zone C in this area.

All VOC concentrations in the groundwater sample collected from monitoring well D-46 were reported as less than PCLs. Zone C appears to be adequately characterized in this area.

All VOC concentrations in the groundwater samples collected from monitoring wells P-61 and P-62 were reported as less than PCLs. The previously reported detections at monitoring well P-60 appear to be limited and Zone A in this area is now adequately characterized.

VOC concentrations reported at monitoring well P-66 were less than PCLs. Based on this data, it appears that the Zone A impacted groundwater in the VCM area is not migrating laterally to the east and the potential source of the low level VOCs (less than PCLs) reported at monitoring well P-50 is not clear.

Zone B monitoring well B-8 was installed approximately 130 feet south of temporary piezometer TPZ-AOC2-B1. All VOC concentrations in the groundwater samples collected from monitoring well B-8 were reported as less than PCLs, thus the lateral extent of the Zone B VCM plume appears to be adequately characterized in this area.

VOC concentrations reported for the sample collected at new monitoring well B-7 exceeded PCLs and were similar to those previously reported for TPZ-AOC2-B-2. Zone B was not present at proposed location B-5 located to the east of B-7, or at previously drilled location SMW-B-1X located to the south of B-7. It is unclear if Zone B is continuous between monitoring wells B-8 and B-6 located to the southeast on the former Brookings Property.

All VOC concentrations in the groundwater samples collected from Zone A monitoring wells P-63, P-64, and P-65, and Zone C monitoring well D-47 were reported as less than PCLs. The lateral extent of the Zone A groundwater impacts identified at monitoring wells P-9 and P-38 appear to be adequately characterized. Zone C does not appear to be impacted in the area southwest of the VCM area.

#### **4.1 Possible Additional Investigation**

As described above, additional investigation may be required to provide further characterization of the following areas:

- Zone A to the east of monitoring well P-68 in the former WWTP Area.
- Zone B to the southeast of monitoring well B-7 east of the VCM Area.
- Zone C to the south and east of monitoring well D-45 in the former WWTP Area.

## 5.0 REFERENCES

PBW, 2012. Pastor, Behling, & Wheeler, LLC, *AOC Characterization Report*. November 9.

Tetra Tech, 2010. Tetra Tech, *Final Risk Management Plan*. April 30.

Tetra Tech, 2012a. Tetra Tech, *Areas of Concern, Characterization Work Plan*. May 4.

Tetra Tech, 2013. Tetra Tech, *Supplemental AOC Characterization Work Plan*. February 28.

Tetra Tech, 2013. Tetra Tech, *Interim Measures Groundwater Monitoring Report, 1<sup>st</sup> Quarter 2013*. June 27.

U.S.EPA , 2000. U.S. Environmental Protection Agency, *Data Quality Objectives Process for Hazardous Waste Site Investigations (QA/G-4HW)*(EPA/600/R-00/007)

U.S.EPA , 2009. U.S. Environmental Protection Agency, *Performance-Base Remedy Decision Document, RCRA Corrective Action for the 1991 EPA Administrative Order, Formosa Plastics Corporation*. October 9.

U.S.EPA , 2010. U.S. Environmental Protection Agency, *Response to Comments/Final Decision Document, Docket No. RCRA-VI-001(h)-90-H*. Signed March 11.

## TABLES



TABLE 1

GROUNDWATER FIELD PARAMETER DATA  
SUPPLEMENTAL AOC CHARACTERIZATION  
FORMOSA PLASTICS CORPORATION, TEXAS

MONITORING WELL ID	pH	CONDUCTIVITY (mS/cm)	TURBIDITY (NTU)	TEMPERATURE (°C)
P-61	6.98	3170	120.0	26.5
P-62	6.86	1720	0.7	25.4
P-63	6.75	753	112.0	27.4
P-64	7.07	1980	26.8	26.9
P-65	6.15	3630	69.0	25.9
P-66	6.35	13800	119.0	29.0
P-68	6.71	6950	50.5	26.4
B-1	6.61	9060	3.1	30.2
B-2	6.48	7880	75.6	24.1
B-3	6.57	7610	20.7	25.9
B-4	6.84	4800	54.9	23.7
B-6	6.71	5520	42.1	26.0
B-7	6.42	11000	19.7	26.3
B-8	6.14	14400	26.5	24.4
D-45	6.57	5690	38.3	26.4
D-46	6.88	5350	9.7	24.6
D-47	10.56	638	15.5	25.6

TABLE 2

SUMMARY OF GROUNDWATER SAMPLE RESULTS  
SUPPLEMENTAL AOC CHARACTERIZATION  
FORMOSA PLASTICS CORPORATION, TEXAS

	SCREENING CRITERIA			Monitoring Well ID															
	MCL (mg/L)	TRRP PCL GW <sub>ing</sub> (mg/L)	1% Solubility (mg/L)	P-61		P-62		P-63		P-64		P-65		P-66		P-68			
				mg/L	Flag	mg/L	Flag	mg/L	Flag	mg/L	Flag	mg/L	Flag	mg/L	Flag	mg/L	Flag		
Volatile Organic Compounds (VOCs)																			
1,1,2-Trichloroethane	0.005	0.005	44.2	<0.00030	U	<0.00030	U	<0.00030	U	<0.00030	U	<0.00030	U	<0.00030	U	0.0013			
1,1-Dichloroethane	15	15	55	<0.00030	U	<0.00030	U	<0.00030	U	<0.00030	U	<0.00030	U	<0.00030	U	0.032			
1,1-Dichloroethene	0.007	0.007	24	<0.00050	U	<0.00050	U	<0.00050	U	<0.00050	U	<0.00050	U	<0.00050	U	<0.00050	U		
1,2-Dichloroethane	0.005	0.005	87	<0.00030	U	<0.00030	U	<0.00030	U	0.00061	J	<0.00030	U	<0.00030	U	0.0050			
1,3-Dichlorobenzene	-	2.2	1.1	<0.00030	U	<0.00030	U	<0.00030	U	<0.00030	U	<0.00030	U	<0.00030	U	<0.00030	U		
Acetone	-	66	6000	<0.0010	U	0.013	U*	0.0084	U*	<0.0010	U	0.0065	U*	0.0092	U*	0.0094	U*		
Benzene	0.005	0.005	17.7	<0.00020	U	<0.00020	U	<0.00020	U	<0.00020	U	<0.00020	U	<0.00020	U	<0.00020	U		
Bromodichloromethane	-	0.033	45	<0.00030	U	0.0030		<0.00030	U	<0.00030	U	<0.00030	U	<0.00030	U	<0.00030	U		
Carbon tetrachloride	0.005	0.005	8.05	<0.00030	U	<0.00030	U	<0.00030	U	<0.00030	U	<0.00030	U	<0.00030	U	<0.00030	U		
Chlorobenzene	0.1	0.1	5.02	<0.00020	U	<0.00020	U	<0.00020	U	<0.00020	U	<0.00020	U	<0.00020	U	<0.00020	U		
Chloroform	-	0.73	79	0.031		0.021		<0.00030	U	0.019		0.0016		0.010		<0.00020	U		
cis-1,2-Dichloroethene	0.07	0.07	49.3	<0.00040	U	<0.00040	U	<0.00040	U	<0.00040	U	<0.00040	U	<0.00040	U	0.011			
Dibromochloromethane	-	0.024	52.5	<0.00040	U	0.00061	J	<0.00040	U	<0.00040	U	<0.00040	U	<0.00040	U	<0.00040	U		
Dichloromethane	0.005	0.005	154	<0.00050	U	0.00077	J	<0.00050	U	<0.00050	U	<0.00050	U	<0.00050	U	<0.00050	U		
Tetrachloroethene	0.005	0.005	2	<0.00040	U	<0.00040	U	<0.00040	U	<0.00040	U	<0.00040	U	<0.00040	U	0.0014			
trans-1,2-Dichloroethene	0.1	0.1	63	<0.00030	U	<0.00030	U	<0.00030	U	<0.00030	U	<0.00030	U	<0.00030	U	0.0011			
Trichloroethene	0.005	0.005	11	<0.00020	U	<0.00020	U	<0.00020	U	<0.00020	U	<0.00020	U	<0.00020	U	0.018			
Vinyl chloride	0.002	0.002	28	<0.00040	U	<0.00040	U	<0.00040	U	<0.00040	U	<0.00040	U	<0.00040	U	0.00078	J		

Notes:  
1) MCL - EPA Maximum Contaminant Level (EPA)

Notes:

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2) 1% of the aqueous solubility

3) mg/L = milligrams per liter

4) Flags:

U = analyzed but not detected above the listed method detection limit

U\* = Data qualified as non-detect due to blank contamination

J = analyte detected below quantitation limit but above method detection limit

Bold value indicates a detection above the method detection limit

Green shading indicates concentration exceeds TRRP PCL GW<sub>ing</sub> value.

TABLE 2

**SUMMARY OF GROUNDWATER SAMPLE RESULTS  
SUPPLEMENTAL AOC CHARACTERIZATION  
FORMOSA PLASTICS CORPORATION, TEXAS**

	SCREENING CRITERIA			Monitoring Well ID															
	MCL (mg/L)	TRRP PCL GW <sub>ing</sub> (mg/L)	1% Solubility (mg/L)	B-1		B-2		B-3		B-4		B-6		B-7		B-8			
				mg/L	Flag	mg/L	Flag	mg/L	Flag	mg/L	Flag	mg/L	Flag	mg/L	Flag	mg/L	Flag		
Volatile Organic Compounds (VOCs)																			
1,1,2-Trichloroethane	0.005	0.005	44.2	0.14		<0.00030	U	<0.00030	U	<0.00030	U	<0.00030	U	0.057		<0.00030	U		
1,1-Dichloroethane	15	15	55	0.086		<0.00030	U	<0.00030	U	<0.00030	U	<0.00030	U	0.040		<0.00030	U		
1,1-Dichloroethene	0.007	0.007	24	0.069		<0.00050	U	<0.00050	U	<0.00050	U	<0.00050	U	0.0047		<0.00050	U		
1,2-Dichloroethane	0.005	0.005	87	0.014		<0.00030	U	<0.00030	U	<0.00030	U	0.0030		0.033		<0.00030	U		
1,3-Dichlorobenzene	-	2.2	1.1	0.00042	J	<0.00030	U	0.00053	J	<0.00030	U	<0.00030	U	<0.00030	U	<0.00030	U		
Acetone	-	66	8000	<0.0010	U	<0.0010	U	<0.0010	U	0.0074	U*	<0.0010	U	<0.0010	U	0.010	U*		
Benzene	0.005	0.005	17.7	0.020		0.00029	J	<0.00020	U	<0.00020	U	<0.00020	U	0.014		<0.00020	U		
Bromodichloromethane	-	0.033	45	<0.00030	U	<0.00030	U	<0.00030	U	<0.00030	U	<0.00030	U	0.0033		<0.00030	U		
Carbon tetrachloride	0.005	0.005	8.05	0.0094		<0.00030	U	<0.00030	U	<0.00030	U	<0.00030	U	0.0030		<0.00030	U		
Chlorobenzene	0.1	0.1	5.02	0.0023		<0.00020	U	<0.00020	U	<0.00020	U	<0.00020	U	0.0019		<0.00020	U		
Chloroform	-	0.73	79	0.78		0.0020		0.0070		0.013		0.015		<0.00030	U	0.017			
cis-1,2-Dichloroethene	0.07	0.07	49.3	0.047		<0.00040	U	<0.00040	U	<0.00040	U	<0.00040	U	0.013		<0.00040	U		
Dibromochloromethane	-	0.024	52.5	<0.00040	U	<0.00040	U	<0.00040	U	<0.00040	U	<0.00040	U	0.00077	J	<0.00040	U		
Dichloromethane	0.005	0.005	154	0.0019	J	<0.00050	U	<0.00050	U	<0.00050	U	<0.00050	U	<0.00050	U	<0.00050	U		
Tetrachloroethene	0.005	0.005	2	0.10		<0.00040	U	<0.00040	U	<0.00040	U	<0.00040	U	0.028		<0.00040	U		
trans-1,2-Dichloroethene	0.1	0.1	63	0.077		<0.00030	U	<0.00030	U	<0.00030	U	<0.00030	U	0.016		<0.00030	U		
Trichloroethene	0.005	0.005	11	0.16		<0.00020	U	<0.00020	U	<0.00020	U	<0.00020	U	0.033		<0.00020	U		
Vinyl chloride	0.002	0.002	28	0.057		<0.00040	U	<0.00040	U	<0.00040	U	<0.00040	U	0.041		<0.00040	U		

## Notes:

1) MCL - EPA Maximum Contaminant Level (EPA)

2) 1% of the aqueous solubility

3) mg/L = milligrams per liter

4) Flags:

U = analyzed but not detected above the listed method detection limit

U\* = Data qualified as non-detect due to blank contamination

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Green shading indicates concentration exceeds TRRP PCL GW<sub>ing</sub> value.

TABLE 2

**SUMMARY OF GROUNDWATER SAMPLE RESULTS  
SUPPLEMENTAL AOC CHARACTERIZATION  
FORMOSA PLASTICS CORPORATION, TEXAS**

	SCREENING CRITERIA			Monitoring Well ID					
	MCL (mg/L)	TRRP PCL GW <sub>ing</sub> (mg/L)	1% Solubility (mg/L)	D-45		D-46		D-47	
				mg/L	Flag	mg/L	Flag	mg/L	Flag
<b>Volatile Organic Compounds (VOCs)</b>									
1,1,2-Trichloroethane	0.005	0.005	44.2	<0.00030	U	<0.00030	U	<0.00030	U
1,1-Dichloroethane	15	15	55	<0.00030	U	<0.00030	U	<0.00030	U
1,1-Dichloroethene	0.007	0.007	24	<0.00050	U	<0.00050	U	<0.00050	U
1,2-Dichloroethane	0.005	0.005	87	<b>0.043</b>		<0.00030	U	<0.00030	U
1,3-Dichlorobenzene	-	2.2	1.1	<0.00030	U	<0.00030	U	<0.00030	U
Acetone	-	66	6000	<0.0010	U	<0.0010	U	0.0085	U*
Benzene	0.005	0.005	17.7	<0.00020	U	<0.00020	U	<0.00020	U
Bromodichloromethane	-	0.033	45	<0.00030	U	<0.00030	U	<b>0.0031</b>	
Carbon tetrachloride	0.005	0.005	8.05	<0.00030	U	<0.00030	U	<0.00030	U
Chlorobenzene	0.1	0.1	5.02	<0.00020	U	<0.00020	U	<0.00020	U
Chloroform	-	0.73	79	<b>0.0073</b>		<b>0.0048</b>		<b>0.046</b>	
cis-1,2-Dichloroethene	0.07	0.07	49.3	<0.00040	U	<0.00040	U	<0.00040	U
Dibromochloromethane	-	0.024	52.5	<0.00040	U	<0.00040	U	<b>0.0011</b>	
Dichloromethane	0.005	0.005	154	<0.00050	U	<0.00050	U	<0.00050	U
Tetrachloroethene	0.005	0.005	2	<0.00040	U	<0.00040	U	<0.00040	U
trans-1,2-Dichloroethene	0.1	0.1	63	<0.00030	U	<0.00030	U	<0.00030	U
Trichloroethene	0.005	0.005	11	<0.00020	U	<0.00020	U	<0.00020	U
Vinyl chloride	0.002	0.002	28	<0.00040	U	<0.00040	U	<0.00040	U

## Notes:

- 1) MCL - EPA Maximum Contaminant Level (EPA)
  - 2) 1% of the aqueous solubility
  - 3) mg/L = milligrams per liter
  - 4) Flags:
    - U = analyzed but not detected above the listed method detection limit
    - U\* = Data qualified as non-detect due to blank contamination
    - J = analyte detected below quantitation limit but above method detection limit
- Bold value indicates a detection above the method detection limit**  
**Green shading indicates concentration exceeds TRRP PCL GW<sub>ing</sub> value.**

TABLE 3

**QA/QC - DUPLICATE SAMPLES VOC ANALYTICAL RESULT  
SUPPLEMENTAL AOC CHARACTERIZATION**

Well Number / ID	D-45		Dup-01		P-68		Dup-02	
Lab Sample / ID	1307039-03A		1307039-12A		1307039-15A		1307039-21A	
Sample Date	6/27/2013		6/27/2013		6/28/2013		6/28/2013	
Analyte	Result (mg/L)	Flag	Result (mg/L)	Flag	Result (mg/L)	Flag	Result (mg/L)	Flag
1,1,2-trichloroethane	<0.00030		<0.00030		0.0013		0.0013	
1,1-dichloroethane	<0.00030		<0.00030		<0.00030		0.03	
1,1-dichloroethene	<0.00050		<0.00050		<0.00050		<0.00050	
1,2-dichloroethane (EDC)	0.043		0.041		0.0050		0.0049	
1,3-dichlorobenzene	<0.00030		0.00041	J	<0.00030		<0.00030	
Acetone	<0.0010		<0.0010		<0.0010		0.01	U
Benzene	<0.00020		<0.00020		<0.00020		<0.00020	
Carbon tetrachloride	<0.00030		<0.00030		<0.00030		<0.00030	
Chloroform	0.0073		0.0071		0.027		0.027	
Cis-1,2-Dichloroethene	<0.00040		<0.00040		<0.00040		0.011	
Dichloromethane	<0.00050		<0.00050		<0.00050		0.00066	J
Tetrachloroethene	<0.00040		<0.00040		0.0014		0.0013	
Trans-1,2-Dichloroethene	<0.00030		<0.00030		<0.00030		0.00097	J
Trichloroethene	<0.00020		<0.00020		0.018		0.017	
Vinyl chloride	<0.00040		<0.00040		0.00078	J	0.00067	J

**Notes:**

See Appendix for complete list of VOC analytes

See Appendix for Data Usability Summary

U - Potentially contaminated; The analyte was not detected >5x (10x for common contaminants) the level in an associated blank and thus should be considered not detected above the level of the associated numerical value (i.e., the reported sample concentration).

J - Lab qualifier indicating the analyte was detected above the sample detection limit (SDL) but below the method quantitation limit (MQL).

TABLE 4

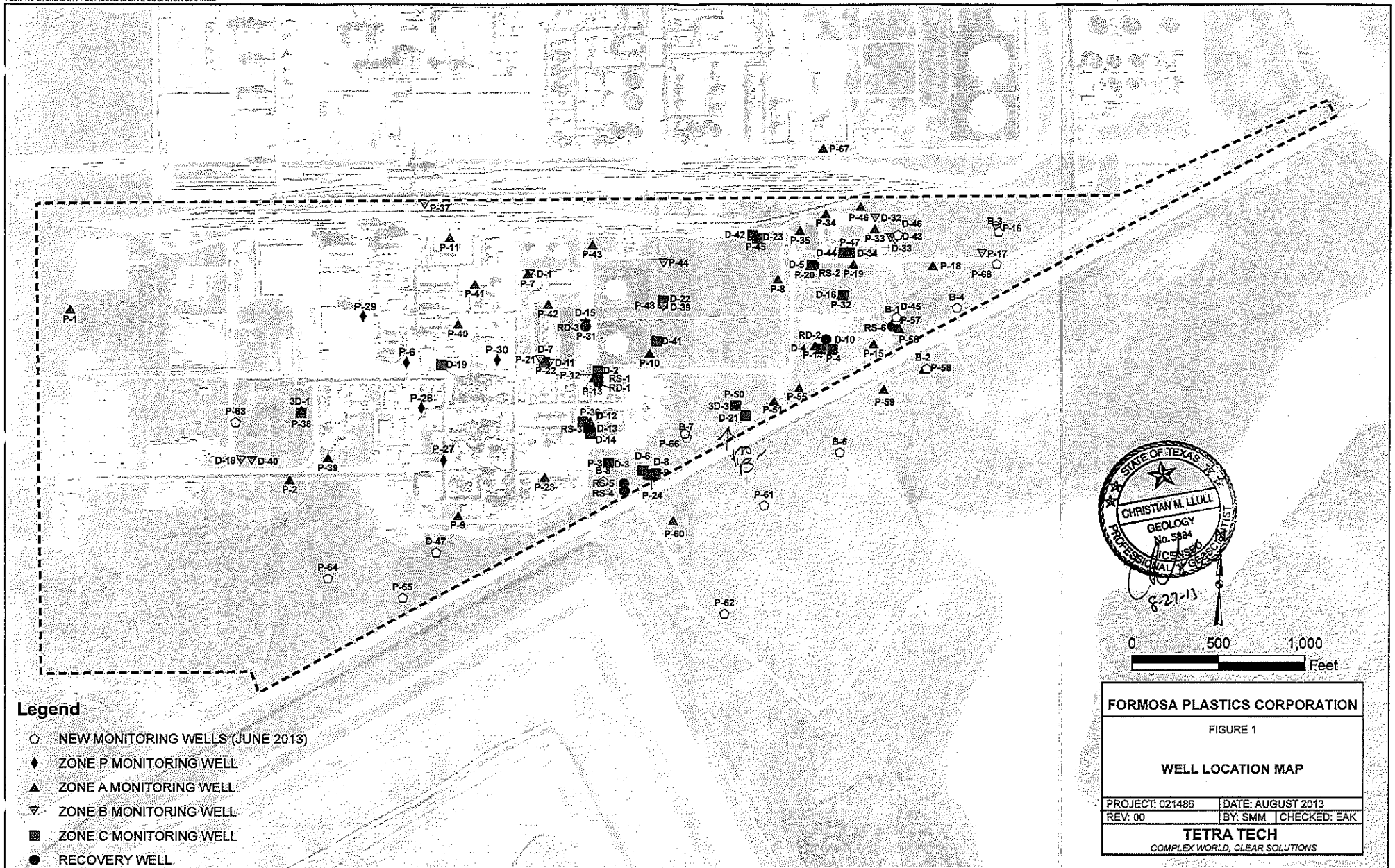
**TRIP AND FIELD BLANK ANALYTICAL RESULTS  
SUPPLEMENTAL AOC CHARACTERIZATION**

Well Number/ID	Trip Blank 1		FB-01		FB-02	
Lab Sample/ID	1307039-22A		1307039-05A		1307039-16A	
Analyte	Result	RL	Result	RL	Result	RL
1,1,1-trichloroethane	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
1,1,2,2-tetrachloroethane	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
1,1,2-trichloro-1,2,2-trifluoroethane	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
1,1,2-trichloroethane	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
1,1-dichloroethane	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
1,1-dichloroethene	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
1,2,4-trichlorobenzene	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
1,2-dibromo-3-chloropropane	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
1,2-dibromoethane	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
1,2-dichlorobenzene	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
1,2-dichloroethane (EDC)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
1,2-dichloropropane	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
1,3-dichlorobenzene	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
1,4-dichlorobenzene	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
2-butanone	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
2-hexanone	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080
4-methyl-2-pentanone	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060
acetone	<0.001	<0.001	0.0062	<0.001	0.0069	<0.001
benzene	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
bromodichloromethane	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
bromoform	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
bromomethane	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
carbon disulfide	<0.00070	<0.00070	<0.00070	<0.00070	<0.00070	<0.00070
carbon tetrachloride	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
chlorobenzene	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
chloroethane	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
chloroform	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
chloromethane	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
cis-1,2-dichloroethene	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
cis-1,3-dichloropropene	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
cyclohexane	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
dibromochloromethane	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
dichlorodifluoromethane	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
dichloromethane	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
ethylbenzene	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
isopropylbenzene	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
m,p-xylene	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060
methyl acetate	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
methyl tert-butyl ether (MTBE)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
methylcyclohexane	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
o-xylene	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
styrene	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
tetrachloroethene	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
toluene	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
trans-1,2-dichloroethene	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
trans-1,3-dichloropropene	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
trichloroethene	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
trichlorofluoromethane	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
vinyl chloride	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
xylenes, total	<0.00090	<0.00090	<0.00090	<0.00090	<0.00090	<0.00090

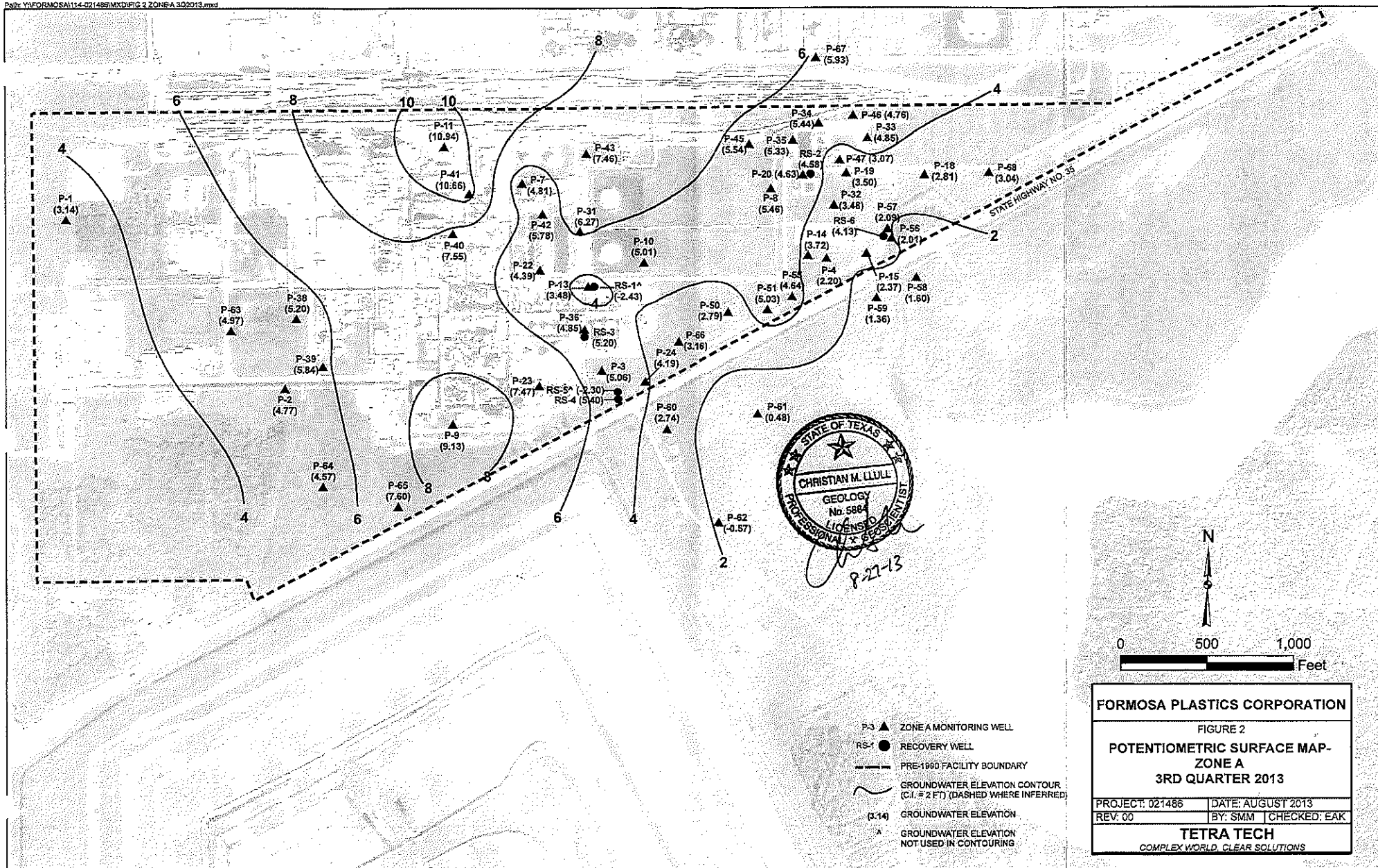
## Notes:

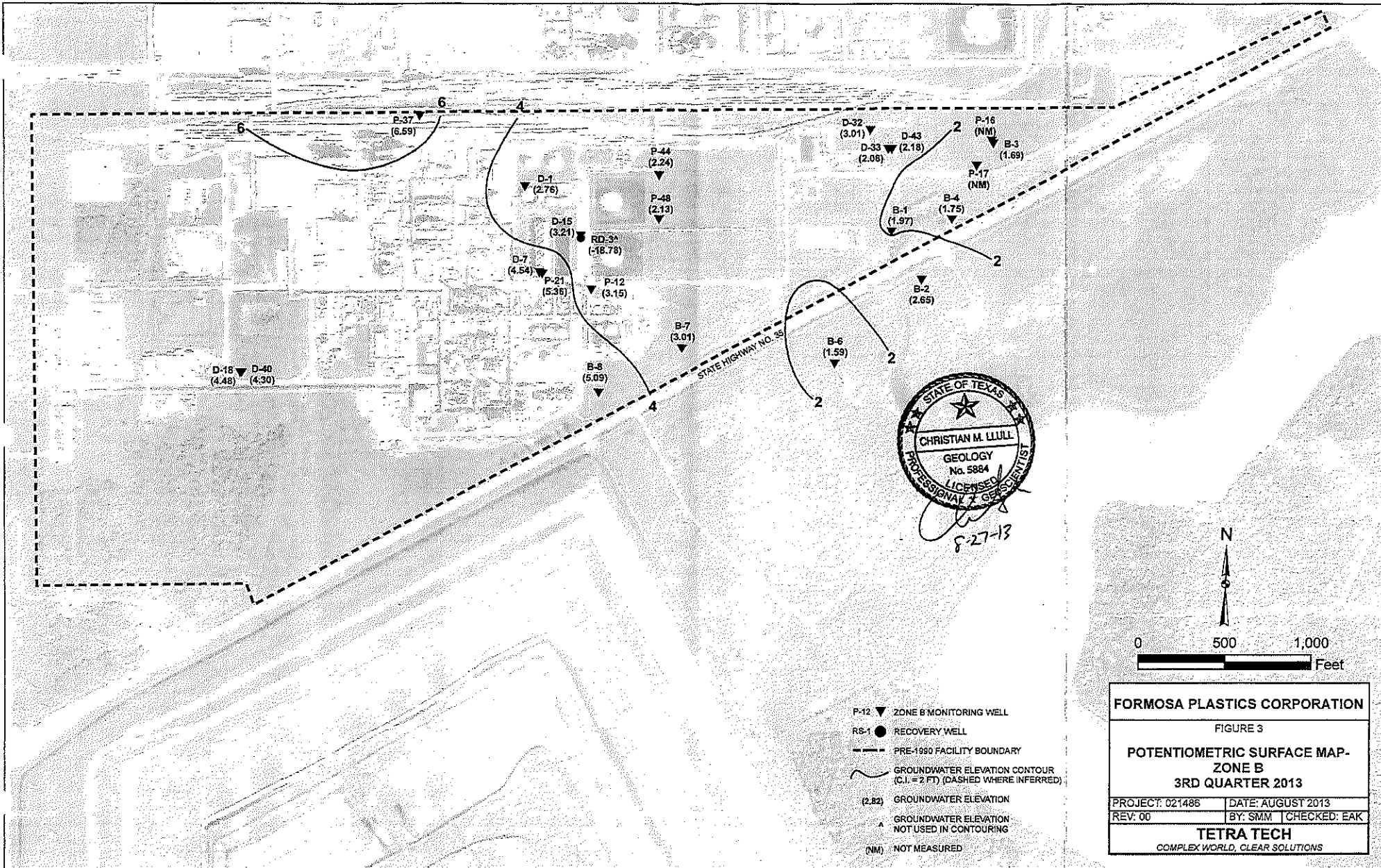
The reviewer qualified all nine detects for acetone as potentially contaminated (U) due to detection of the analyte in the associated field blank. In each case, the analyte should be considered not detected at or above the reported concentration.

## FIGURES









**FORMOSA PLASTICS CORPORATION**

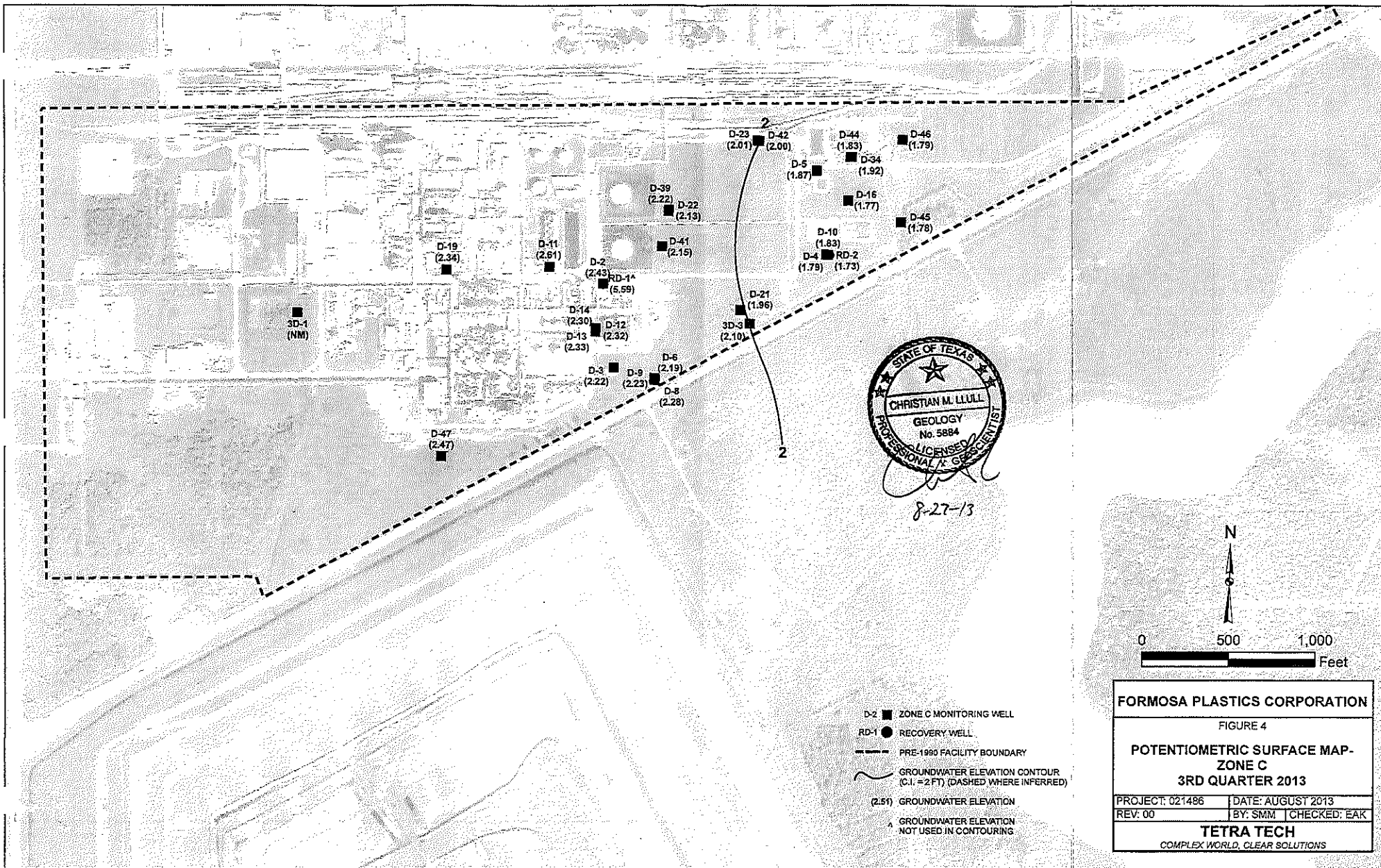
FIGURE 3

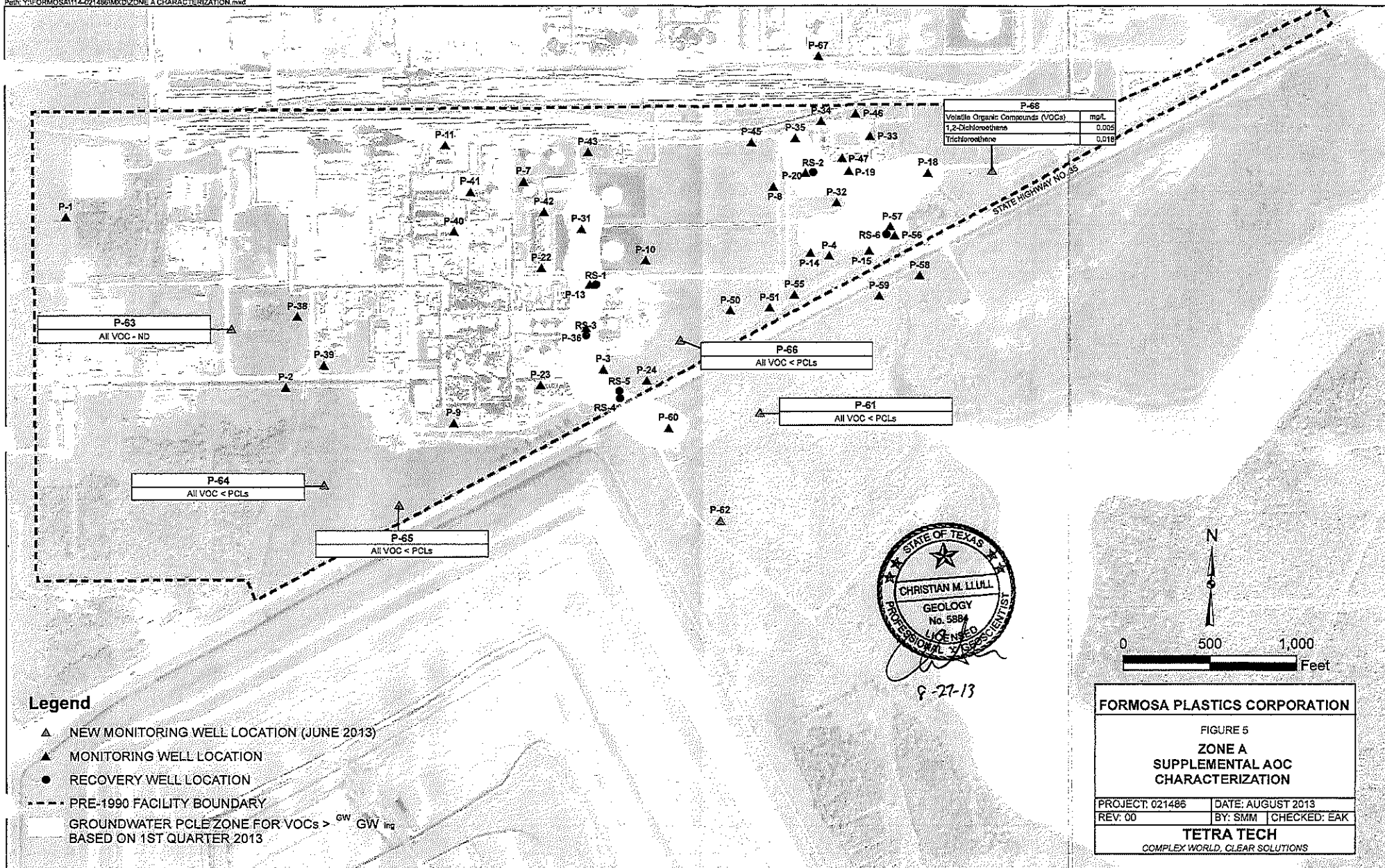
**POTENTIOMETRIC SURFACE MAP-  
ZONE B  
3RD QUARTER 2013**

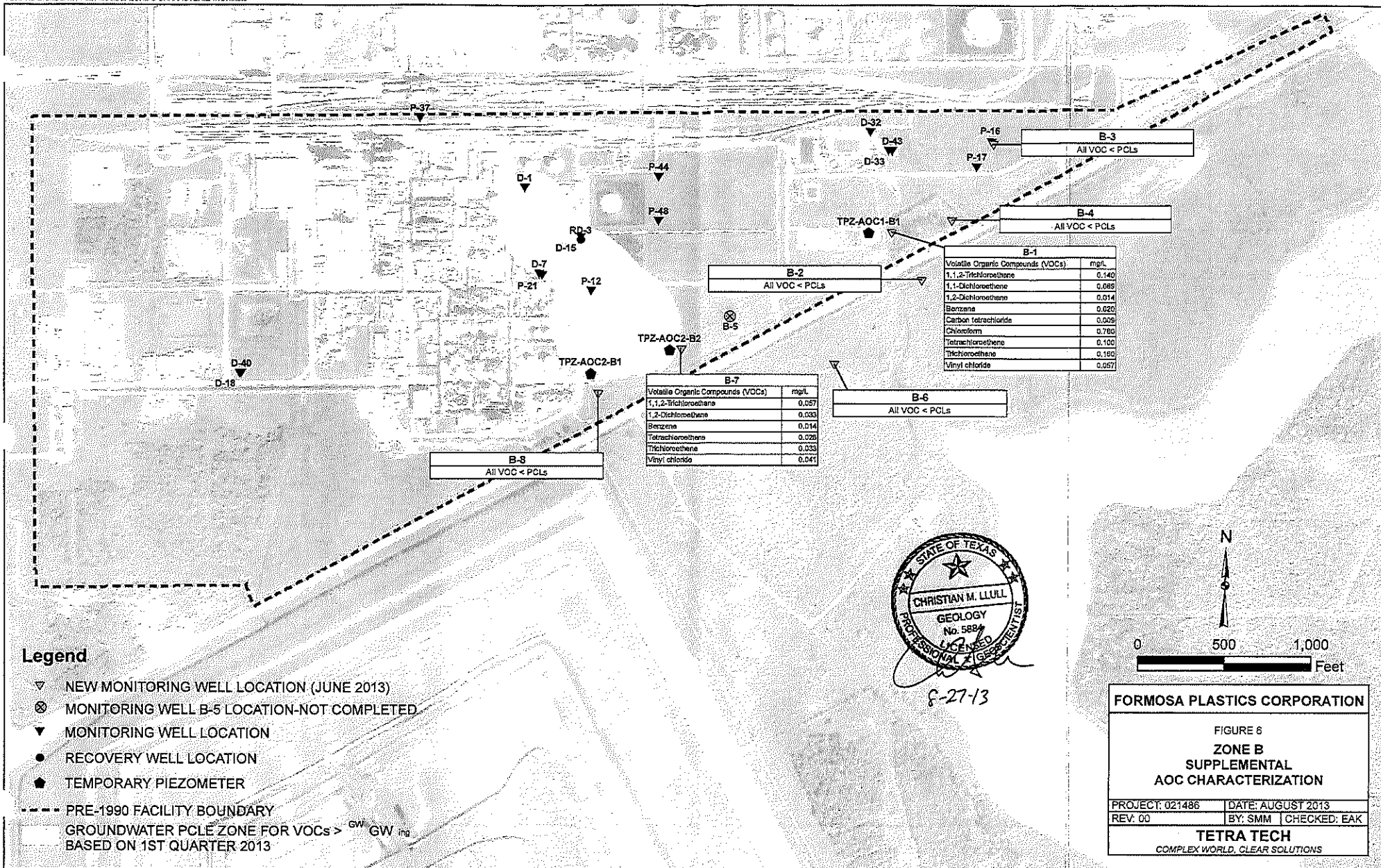
PROJECT: 021486	DATE: AUGUST 2013
REV: 00	BY: SMM CHECKED: EAK

**TETRA TECH**

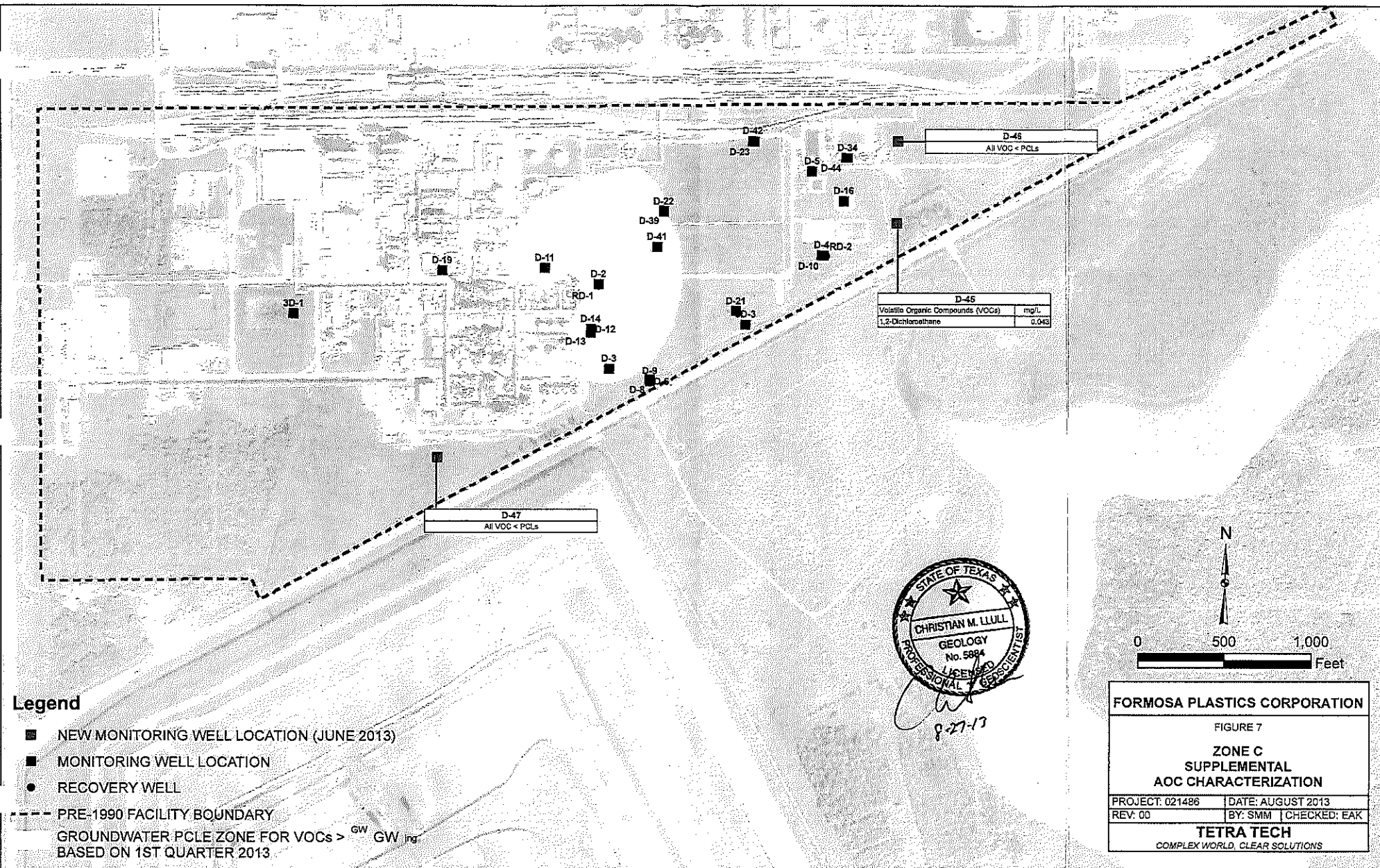
COMPLEX WORLD, CLEAR SOLUTIONS











## **APPENDIX A BORING LOGS**



TETRA TECH

## LOG OF BORING B-1

Page  
1 of 3

Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: Former WWTP

Surface Elevation: 14.69

Borehole Number: B-1

Borehole  
Diameter (in.):

Date Started: 6/12/2013

Date Finished: 6/12/2013

## WATER LEVEL OBSERVATIONS

While Drilling  $\nabla$  m Upon Completion of Drilling  $\nabla$  m

Remarks:

## MATERIAL DESCRIPTION

## WELL DIAGRAM

Casing Top Elev. 17.63 (ft)  
Casing Type: S.S.

-CL- SILTY CLAY: Mottled dark brown and reddish tan, very stiff, with roots and organic material, dry.

-OH- ORGANIC CLAY: Dark brown to black, soft, with organic material throughout, with roots, wet.

-CL- SILTY CLAY: Dark gray brown, stiff, with roots and calcareous material, dry.

-CL- SILTY CLAY: Brown to gray brown, stiff to medium stiff, with abundant calcareous nodules.

-CL- SILTY CLAY: Reddish tan, medium stiff, with calcareous nodules, jointed.

-- Thin silt layer, reddish tan and white, loose, highly calcareous @ 4.1-4.4 ft.

-CL- SANDY CLAY: Reddish tan, soft to medium stiff, with very fine grained sand/silt throughout, with occasional clayey lenses, jointed, slightly moist.

-CL- SILTY CLAY: Reddish tan, medium stiff to stiff, jointed, with manganese oxide staining, lighter with depth.

-- Calcareous @ 10.5-11 ft.

-CL- SANDY CLAY: Light reddish tan to light brown, medium stiff to stiff, with oxidation staining, with occasional light gray mottling.

-SM- SILTY SAND: Light brown, loose, with very fine grained sand/silt, non-cohesive, slightly clayey.

-CL- SANDY CLAY: Mottled reddish tan and gray, stiff to very stiff, with manganese oxide staining and oxidation, jointed.

-SM- SILTY SAND: Light brown, loose, with very fine grained sand/silt, non-cohesive, slightly clayey.

-CH- FAT CLAY: Reddish tan, very stiff to hard, with manganese oxide nodules and oxidized zones.

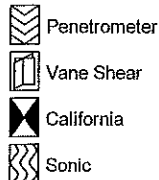
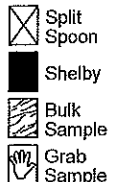
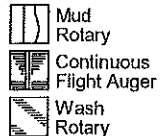
-- Mottled with tan @ 17 ft.

-CH- FAT CLAY: Light gray occasionally mottled with reddish tan, very stiff to stiff, with abundant calcareous nodules and oxidation staining.

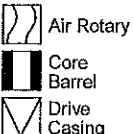
-CH- FAT CLAY: Light tan with gray mottling, very stiff, with abundant calcareous material, with occasional calcareous nodules.

-- SILTY CLAY (CL) zone @ 21.5-22 ft, grading to SANDY FAT CLAY (CH) @ 23-24 ft.

-CH- SANDY FAT CLAY: Mottled gray and reddish tan, medium stiff, with abundant oxidation staining and calcareous

Sampler  
Types:Operation  
Types:

Auger



Notes:

Logger: Christian M. Llull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear



Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: Former WWTP

Surface Elevation: 14.69

Borehole Number: B-1

Borehole  
Diameter (in.):

Date Started: 6/12/2013

Date Finished: 6/12/2013

**WATER LEVEL OBSERVATIONS**

While Drilling  $\nabla$  m Upon Completion of Drilling  $\nabla$  m

Remarks:

**MATERIAL DESCRIPTION**

**WELL DIAGRAM**

DEPTH (ft)	OPERATION TYPES	SAMPLE	STANDARD PENETRATION TEST	PID (ppm)	SAMPLE RECOVERY (%)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	LIQUID LIMIT	PLASTICITY INDEX	MINUS NO. 200 (%)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	WELL DIAGRAM
			SPT					L	PI					
27				4.6								nodules. -- Grading to FAT CLAY (CH) with abundant calcareous nodules, more reddish tan and very stiff @ 27 ft.	27	
30.3				0								-CH- FAT CLAY: Light gray and reddish tan, very stiff to hard, with occasional oxidation and calcareous nodules.	30.3	
32.5				0								-CH- SANDY FAT CLAY: Gray and tan with some light brown mottling, soft to medium stiff, with oxidation throughout.	32.5	
34				0								-CH- FAT CLAY: Gray, very stiff to hard, blocky, heavily oxidized, with calcareous material throughout. -- Slickensides, fracture planes @ 33.5 ft.	34	
35				0								-ML- CLAYEY SAND: Tan and light brown, soft, moderately to heavily oxidized, moist, grading to CLAYEY SILT (ML). -ML- CLAYEY SILT: Yellowish brown and light brown, soft to medium stiff, no oxidation, no calcareous material, moist.	35	
38.5				0.4								-CL- SILTY CLAY: Tan and gray, very stiff to hard, slightly sandy, with abundant calcareous material and nodules, oxidized.	38.5	
42.5				0								-- Becoming more tan @ 42.5 ft.		
43.8				0								-- Slickenside feature @ 43.8 ft.		
46.0				0								-- Heavily calcareous on fracture planes @ 42.5 ft and 46.0 ft.		
47				0								-- Slickenside, 45 degrees from horizontal, with large calcareous nodules and staining @ 47 ft.	48	
48				0								-CL- SILTY CLAY: Tan and reddish tan, very stiff to hard, with calcareous nodules.	50	

<b>Sampler Types:</b> <input checked="" type="checkbox"/> Split Spoon <input checked="" type="checkbox"/> Shelby <input checked="" type="checkbox"/> Bulk Sample <input checked="" type="checkbox"/> Grab Sample <input type="checkbox"/> Penetrometer <input type="checkbox"/> Vane Shear <input type="checkbox"/> California <input type="checkbox"/> Sonic	<b>Operation Types:</b> <input type="checkbox"/> Mud Rotary <input type="checkbox"/> Continuous Flight Auger <input type="checkbox"/> Wash Rotary <input type="checkbox"/> Auger <input type="checkbox"/> Air Rotary <input type="checkbox"/> Core Barrel <input type="checkbox"/> Drive Casing	<b>Notes:</b>
---	--	---------------

Logger: Christian M. Lull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear



Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: Former WWTP

Surface Elevation: 14.69

Borehole Number: B-1

Borehole  
Diameter (in.):

Date Started: 6/12/2013

Date Finished: 6/12/2013

## WATER LEVEL OBSERVATIONS

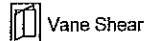
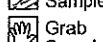
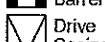
While Drilling    m Upon Completion of Drilling    m

Remarks:

## MATERIAL DESCRIPTION

## WELL DIAGRAM

Bottom of borehole at 57.0 feet.

Sampler  
Types:Operation  
Types:

Notes:

Logger: Christian M. Lull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear



Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: Former Brookings Property

Surface Elevation: 15.3

Borehole Number: B-2

Borehole  
Diameter (in.):

Date Started: 6/21/2013

Date Finished: 6/21/2013

## WATER LEVEL OBSERVATIONS

While Drilling  $\nabla$  m Upon Completion of Drilling  $\nabla$  m

Remarks:

## MATERIAL DESCRIPTION

## WELL DIAGRAM

Casing Top Elev. 18.05 (ft)  
Casing Type: S.S.-CL- SILTY CLAY: Mottled brown and reddish brown,  
medium stiff, with roots.-CL- SILTY CLAY: Dark brown to black, soft to medium  
stiff.

-- Dry, slightly friable @ 1-3 ft.

-- Slightly moist @ 3-4 ft.

-CL- SILTY CLAY: Reddish tan to light reddish tan, medium  
stiff to stiff, with calcareous material.

-- Thick SILT (ML) layer @ 5-6 ft.

-CH- FAT CLAY: Reddish brown with occasional gray  
mottling, medium stiff to stiff, with occasional manganese  
oxide staining.

-- Thin, SANDY CLAY (CL) @ 8.8-9 ft.

-CL- SANDY CLAY: Reddish tan, soft, with yellowish  
brown, loose SILTY SAND (SM) lenses.

-- SILTY SAND (SM) layer @ 11-12 ft.

-CL- SILTY CLAY: Light reddish brown to reddish tan, soft  
to medium stiff, with occasional gray mottling, jointed, fatter  
with depth.

-- SILT (ML) with thin clayey lenses @ 16.5-17 ft.

-SM- SILTY SAND: Light brown to yellowish brown, loose,  
very fine grained.

-- With clayey lenses @ 18-18.5 ft.

-CL- SILTY CLAY: Light gray with yellowish brown mottling,  
stiff to medium stiff, with occasional calcareous nodules.-CL- SILTY CLAY: Light gray mottled with abundant  
manganese oxide specks, soft to medium stiff, with  
occasional tan layers at depth.-CL- SILTY CLAY: Light brown and tan, soft to medium  
stiff, with common calcareous nodules.

-- Softer and sandier @ 23-24 ft.

-CL- SILTY CLAY: Yellowish brown and gray, occasionally  
mottled with reddish tan, medium stiff, with calcareousSampler  
Types:Split  
Spoon

Shelby

Bulk  
SampleGrab  
Sample

Penetrometer



Vane Shear



California



Sonic

Operation  
Types:Mud  
RotaryContinuous  
Flight AugerWash  
Rotary

Auger



Air Rotary

Core  
BarrelDrive  
Casing

Notes:

Logger: Christian M. Llull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear



Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: Former Brookings Property

Surface Elevation: 15.3

Borehole Number: B-2

Borehole  
Diameter (in.):

Date Started: 6/21/2013

Date Finished: 6/21/2013

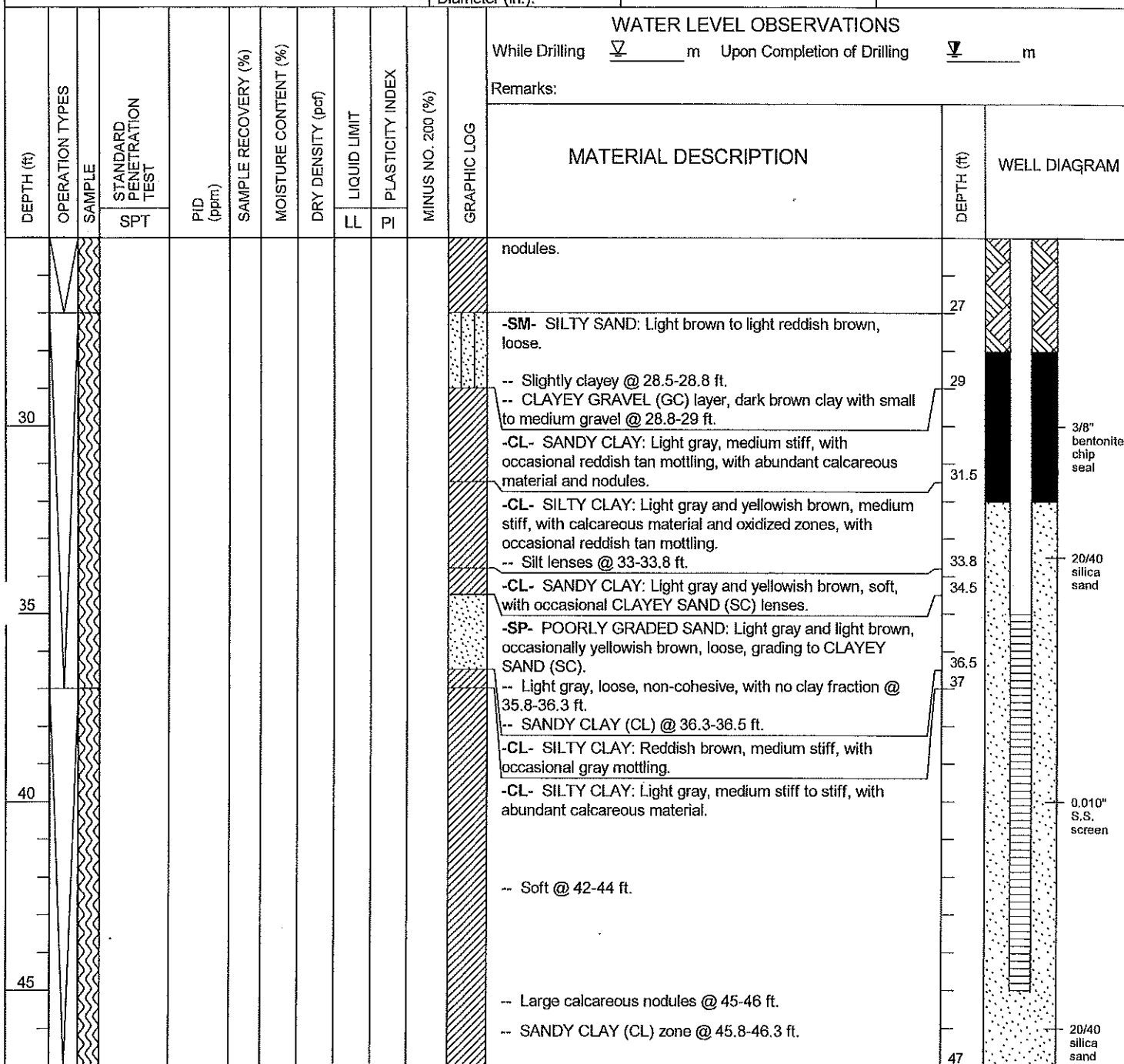
## WATER LEVEL OBSERVATIONS

While Drilling  $\nabla$  m Upon Completion of Drilling  $\nabla$  m

Remarks:

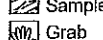
## MATERIAL DESCRIPTION

## WELL DIAGRAM

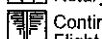
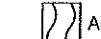
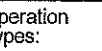


Bottom of borehole at 47.0 feet.

## Sampler Types:



## Operation Types:



Notes:

Logger: Christian M. Lull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear



Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: Former WWTP

Surface Elevation: 20.04

Borehole Number: B-3

Borehole  
Diameter (in.):

Date Started: 6/16/2013

Date Finished: 6/16/2013

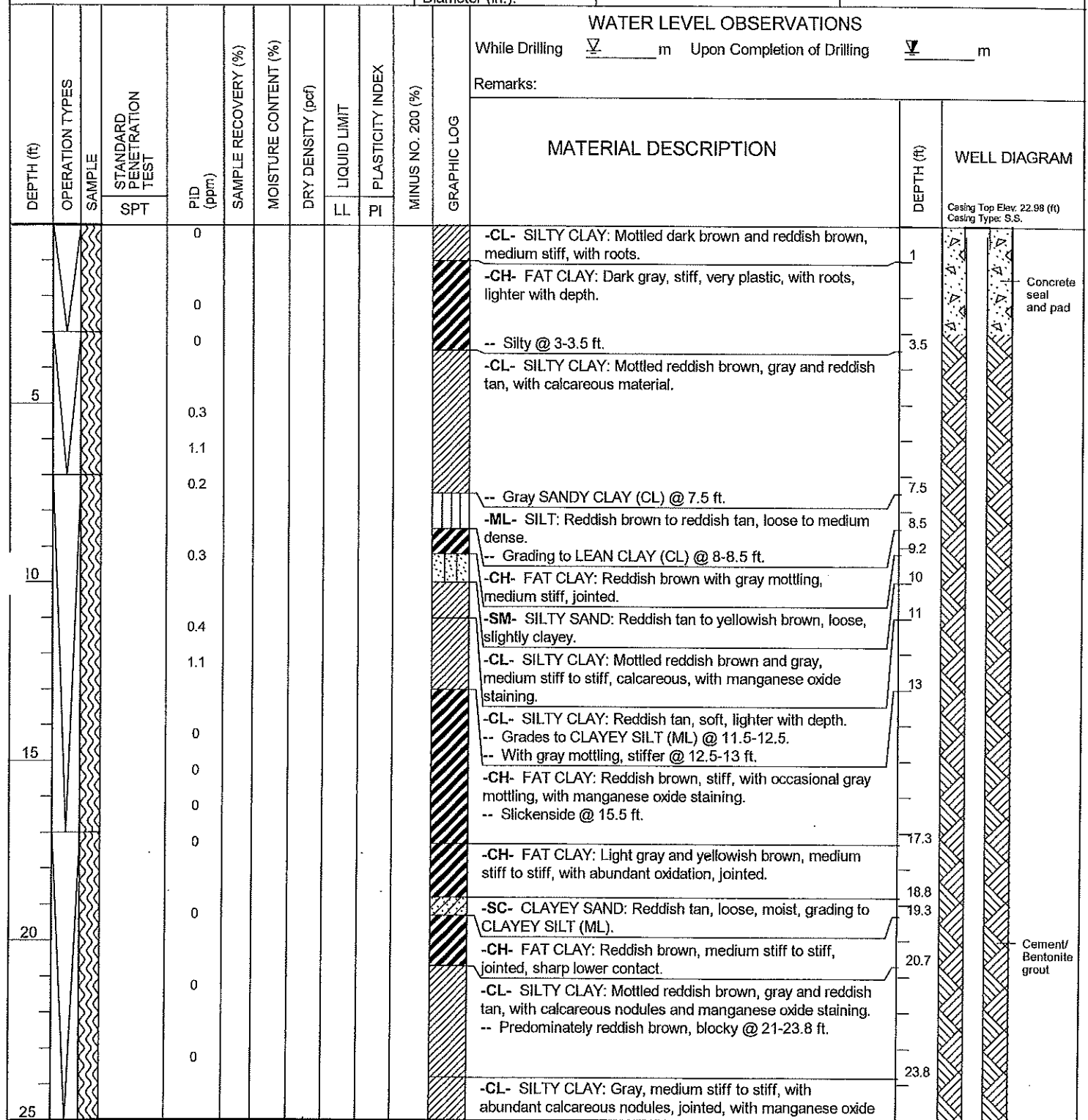
## WATER LEVEL OBSERVATIONS

While Drilling  $\nabla$  m Upon Completion of Drilling  $\nabla$  m

Remarks:

## MATERIAL DESCRIPTION

## WELL DIAGRAM

Casing Top Elev: 22.98 (ft)  
Casing Type: S.S.Sampler  
Types:Split  
Spoon

Penetrometer



Shelby



Vane Shear

Bulk  
Sample

California

Grab  
Sample

Sonic

Operation  
Types:Mud  
RotaryContinuous  
Flight AugerWash  
Rotary

Auger



Air Rotary

Core  
BarrelDrive  
Casing

Notes:

Logger: Christian M. Lull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear



TETRA TECH

## LOG OF BORING B-3

Page  
2 of 3

Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: Former WWTP

Surface Elevation: 20.04

Borehole Number: B-3

Borehole  
Diameter (in.):

Date Started: 6/16/2013

Date Finished: 6/16/2013

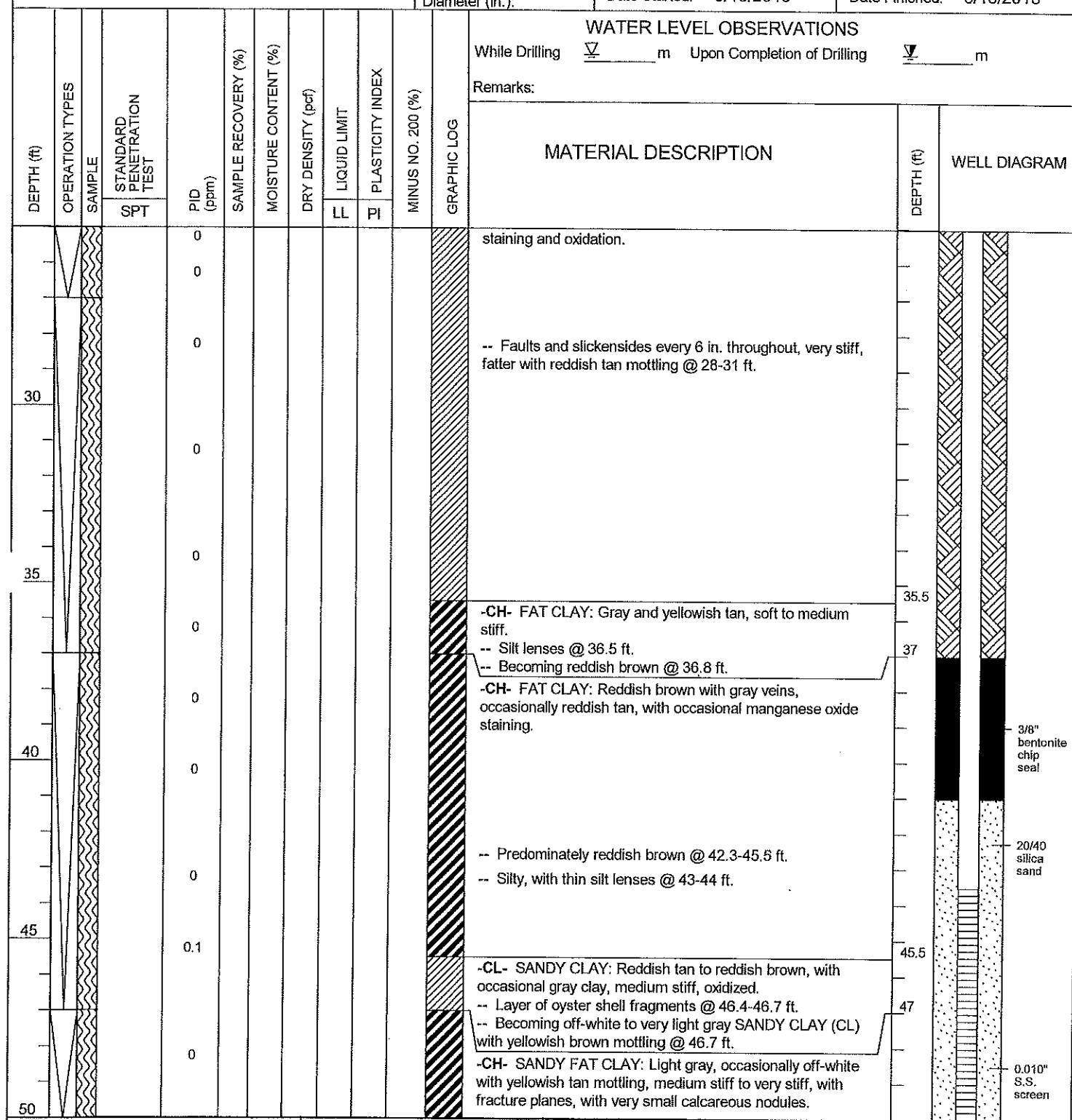
## WATER LEVEL OBSERVATIONS

While Drilling  $\nabla$  m Upon Completion of Drilling  $\nabla$  m

Remarks:

## MATERIAL DESCRIPTION

## WELL DIAGRAM

Sampler  
Types:Split  
Spoon

Shelby

Bulk  
SampleGrab  
Sample

Penetrometer



Vane Shear



California



Sonic

Operation  
Types:Mud  
RotaryContinuous  
Flight AugerWash  
Rotary

Auger



Air Rotary

Core  
BarrelDrive  
Casing

Notes:

Logger: Christian M. Lull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear



Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: Former WWTP

Surface Elevation: 20.04

Borehole Number: B-3

Borehole  
Diameter (in.):

Date Started: 6/16/2013

Date Finished: 6/16/2013

## WATER LEVEL OBSERVATIONS

While Drilling  $\nabla$  m Upon Completion of Drilling  $\nabla$  m

Remarks:

## MATERIAL DESCRIPTION

## WELL DIAGRAM

-- Slickenside, soft @ 48 ft.

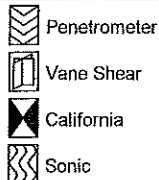
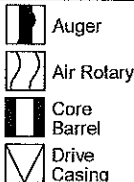
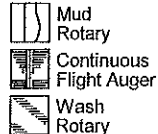
-- Natural fracture, increased yellowish brown mottling @ 51.5 ft.

-- Heavily calcareous, with abundant large nodules, manganese oxide staining, and abundant oxidation @ 51.5-53.5 ft.

-CH- FAT CLAY: Light gray and yellowish brown, medium stiff to stiff, with abundant oxidation and calcareous nodules.

-CL- SILTY CLAY: Reddish brown with gray mottling, medium stiff, slightly sandy, with trace calcareous material and oxidation staining.

Bottom of borehole at 57.0 feet.

Sampler  
Types:Operation  
Types:

Notes:

Logger: Christian M. Liull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear



TETRA TECH

## LOG OF BORING B-4

Page  
1 of 2

Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: Former TxDOT Picnic Area

Surface Elevation: 17.8

Borehole Number: B-4

Borehole  
Diameter (in.):

Date Started: 6/21/2013

Date Finished: 6/21/2013

## WATER LEVEL OBSERVATIONS

While Drilling  $\nabla$  m Upon Completion of Drilling  $\nabla$  m

Remarks:

## MATERIAL DESCRIPTION

## WELL DIAGRAM

Casing Top Elev. 20.3 (ft)  
Casing Type: S.S.

-CL- SILTY CLAY: Dark brown to black, soft to medium stiff, organic-rich.

-- Grading to ORGANIC CLAY (OH) @ 0-2 ft.  
-- Transition zone with reddish brown mottling @ 2.5-3 ft.-CL- SILTY CLAY: Reddish brown, medium stiff, with occasional manganese oxide staining.  
-- Gray mottling @ 4-5 ft.

-- SILT (ML) @ 5-6 ft.

-- Reddish tan in part @ 6-7 ft.

-- Slightly moist @ 7-8 ft.

-- Blocky @ 8-9 ft.

-- Increasing gray veins @ 9-13 ft.

-ML- SILT: Light reddish brown to yellowish brown, loose, very fine grained, with interbedded layers.

-- SANDY CLAY (CL) layer @ 15.5-15.7 ft.

-- CLAYEY SAND (SC) layer @ 16.6-16.8 ft.

-SM- SILTY SAND: Light brown to yellowish brown, loose, very fine to fine grained, wet.

-CL- SILTY CLAY: Light reddish brown to reddish tan, occasionally reddish brown, soft to medium stiff, with occasional gray and yellowish brown mottling.

-- Transition zone, mottled, thinly laminated @ 17.8-18.8 ft.

-CH- FAT CLAY: Reddish brown, medium stiff to stiff, with abundant manganese oxide staining, grading to SILTY CLAY (CL).

-- Fluid-filled fracture, very soft @ 19.8-19.9 ft.

-CL- SILTY CLAY: Light gray to gray, occasionally greenish gray, very stiff to hard, with abundant calcareous nodules and iron nodules, more plastic at depth.

Sampler  
Types:Split  
Spoon

Penetrometer



Shelby



Vane Shear

Bulk  
Sample

California

Grab  
Sample

Sonic

Operation  
Types:

Auger

Mud  
RotaryContinuous  
Flight AugerWash  
Rotary

Air Rotary

Core  
BarrelDrive  
Casing

Notes:

Logger: Christian M. Liull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear





Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: Former TxDOT Picnic Area

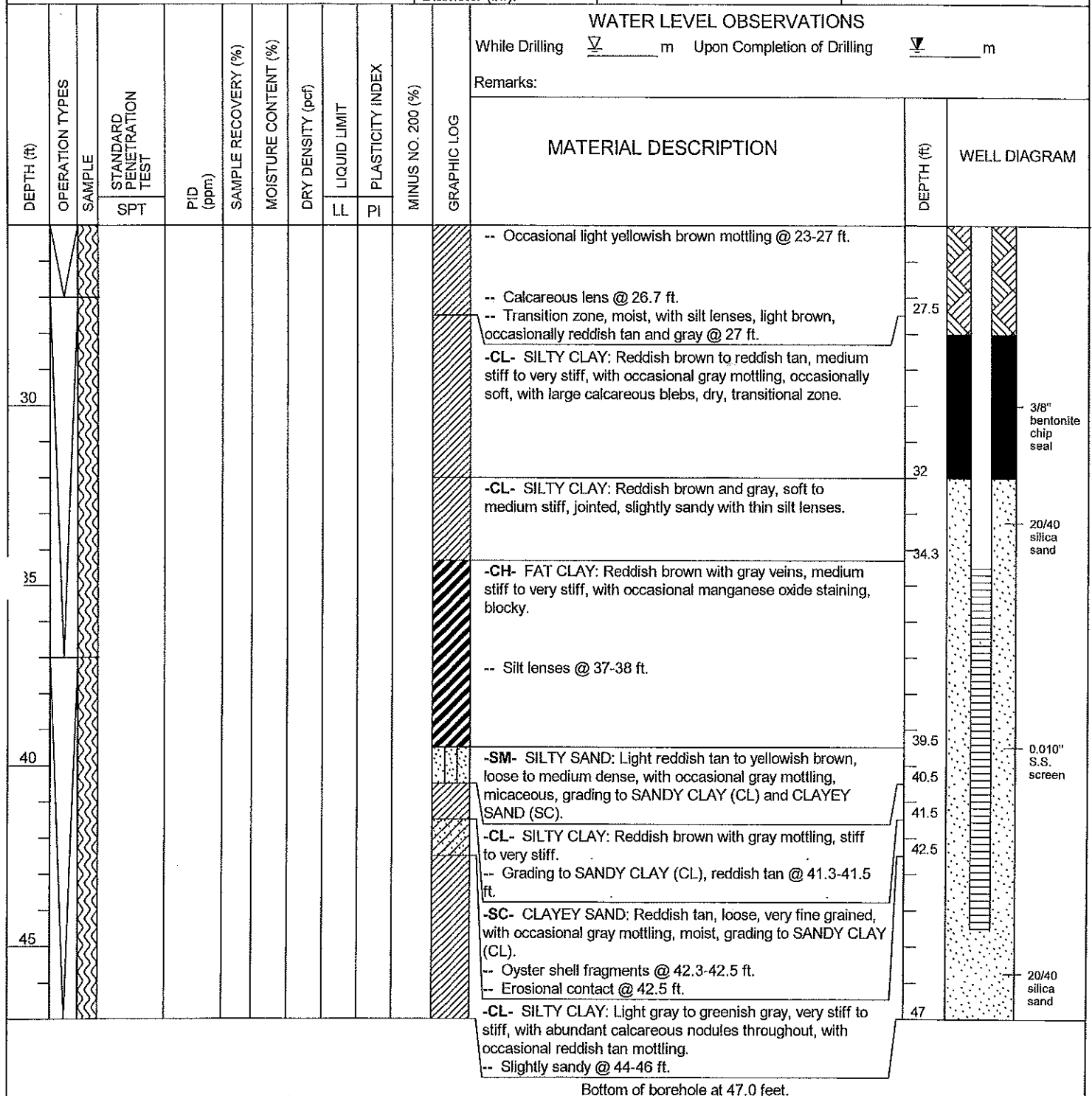
Surface Elevation: 17.8

Borehole Number: B-4

Borehole  
Diameter (in.):

Date Started: 6/21/2013

Date Finished: 6/21/2013



Sampler Types:



Split Spoon



Penetrometer



Shelby



Vane Shear



Bulk Sample



California



Grab Sample



Sonic

Operation Types:



Mud Rotary



Continuous Flight Auger



Wash Rotary



Auger



Air Rotary



Core Barrel



Drive Casing

Notes:

Logger: Christian M. Lull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear



Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: VCM Area

Surface Elevation: 19

Borehole Number: B-5

Borehole  
Diameter (in.):

Date Started: 6/19/2013

Date Finished: 6/19/2013

## WATER LEVEL OBSERVATIONS

While Drilling  $\nabla$  m Upon Completion of Drilling  $\nabla$  m

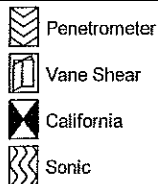
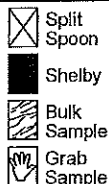
Remarks:

## MATERIAL DESCRIPTION

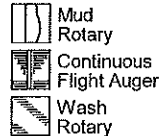
WELL DIAGRAM

DEPTH (ft)	OPERATION TYPES	SAMPLE	STANDARD PENETRATION TEST	PID (ppm)	SAMPLE RECOVERY (%)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	LIQUID LIMIT	PLASTICITY INDEX	MINUS NO. 200 (%)	GRAPHIC LOG	DEPTH (ft)	WELL DIAGRAM
			SPT										
5				0							-CL- SILTY CLAY: Brown, soft, with organic material and roots, slightly moist. -- Thin reddish brown layer @ 1.3-1.5 ft.	1.5	
				0							-CL- SILTY CLAY: Dark gray to dark gray brown, soft to medium stiff, stiffer with depth. -- Occasional yellowish brown mottling @ 3-3.5 ft.	3.5	
				0							-CL- SILTY CLAY: Brown to light reddish brown, medium stiff to stiff, with manganese oxide staining, with small calcareous nodules. -- More reddish brown @ 5-6 ft.	6	
				0							-CL- SILTY CLAY: Reddish tan to light reddish brown, loose, occasionally mottled, with occasional gray laminae, grading to CLAYEY SILT (ML). -- Thick layers of silty clay interbedded with silts @ 7-9 ft.	9	
10				0							-CL- SILTY CLAY: Reddish brown with gray veins, medium stiff to stiff, blocky, waxy, with occasional manganese oxide staining, grading to FAT CLAY (CH).		
				0								12.5	
				0							-CH- FAT CLAY: Reddish brown, medium stiff, with trace gray veins and manganese oxide staining, grading to SILTY CLAY (CL) in part.		
15				0								16	
				0							-CH- FAT CLAY: Gray, medium stiff, with reddish and yellowish brown veins. -- Transition zone @ 16.5 ft.	16.5	
				0							-SC- CLAYEY SAND: Reddish tan and yellowish brown, occasionally light gray, medium dense, with silt lenses throughout, grading to SANDY SILT (ML) in part.	17.5	
20				0							-CL- SILTY CLAY: Reddish brown and reddish tan, medium stiff to stiff, jointed, with abundant manganese oxide staining, with gray mottling. -- Thin (~1 inch) CLAYEY SAND (SC) stringer, soft, loose @ 18.5 ft. -- With gray clay veins @ 19.5-20 ft. -- Thin calcareous nodules layer @ 20-20.1 ft.		
				0							-CL- SANDY CLAY: Light gray to greenish gray, soft to medium stiff, with abundant calcareous nodules, with yellowish brown mottling at depth and increased large calcareous nodules.	21	
25													

Sampler Types:



Operation Types:



Notes:

Logger: Christian M. Llull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear



TETRA TECH

## LOG OF BORING B-5

Page  
2 of 2

Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: VCM Area

Surface Elevation: 19

Borehole Number: B-5

Borehole  
Diameter (in.):

Date Started: 6/19/2013

Date Finished: 6/19/2013

## WATER LEVEL OBSERVATIONS

While Drilling    m Upon Completion of Drilling    m

Remarks:

## MATERIAL DESCRIPTION

WELL DIAGRAM

DEPTH (ft)	OPERATION TYPES	SAMPLE	STANDARD PENETRATION TEST	PID (ppm)	SAMPLE RECOVERY (%)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	LIQUID LIMIT	PLASTICITY INDEX	MINUS NO. 200 (%)	GRAPHIC LOG	DEPTH (ft)	WELL DIAGRAM
			SPT					LL	PI				
26				0									
				0									
				0									
30				0									
				0									
35				0									
				0									
40				0									
				0									
45				0									
				0									
47				0									

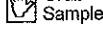
Bottom of borehole at 47.0 feet.

Sampler  
Types:

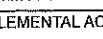
Split Spoon



Shelby



Bulk Sample



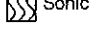
Grab Sample



Penetrometer



Vane Shear



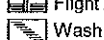
California



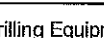
Sonic

Operation  
Types:

Mud Rotary



Continuous Flight Auger



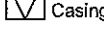
Wash Rotary



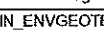
Auger



Air Rotary



Core Barrel



Drive Casing

Notes:

Logger: Christian M. Lull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear



Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: Former Brookings Property

Surface Elevation: 16.19

Borehole Number: B-6

Borehole  
Diameter (in.):

Date Started: 6/22/2013

Date Finished: 6/22/2013

## WATER LEVEL OBSERVATIONS

While Drilling  $\nabla$  m Upon Completion of Drilling  $\nabla$  m

Remarks:

## MATERIAL DESCRIPTION

## WELL DIAGRAM

Casing Top Elev. 18.88 (ft)  
Casing Type: S.S.

-CL- SILTY CLAY: Brown to gray brown, very stiff, with abundant roots, small gravel, and iron nodules, dry.

-- Reddish tan @ 2.5-3 ft.

-CL- SILTY CLAY: Reddish brown and reddish tan, medium stiff to stiff, with occasional light brown mottling, with occasional calcareous material and thin silt lenses, stiffer with depth.

-- Blocky, with occasional gray veins and manganese oxide staining @ 5-7 ft.

-- Slickenside at 45 degree angle @ 11 ft.

-- Slightly moist and grading to FAT CLAY (CH) @ 11-12.5 ft.

-CL- SILTY CLAY: Light gray and yellowish brown, medium stiff to stiff, with calcareous material.

-- Erosional contact @ 13 ft.

-CL- SANDY CLAY: Reddish tan to reddish brown, soft, with very fine grained sand, thin laminae with silt and clay interbedding.

-- Slightly moist, silty @ 13.5 ft.

-CH- FAT CLAY: Reddish brown, stiff, with occasional oxidation staining, with occasional reddish tan and gray jointing.

-- Manganese oxide staining @ 15-17 ft.

-- Thin sand and silt, moist @ 15.3 ft.

-CL- SILTY CLAY: Mottled reddish brown, reddish tan, gray, and yellowish brown, medium stiff to very stiff, blocky.

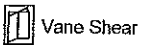
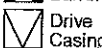
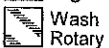
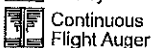
-CL- SILTY CLAY: Light gray with occasional reddish tan and yellowish tan mottling, grading to SANDY CLAY (CL).

-- Thin, wet, clayey sand lenses (1 inch thick) @ 19 ft.

-- SANDY CLAY (CL) @ 19.5-22 ft.

-- Light gray and yellowish brown, soft, occasionally very soft, with gray laminae and abundant calcareous nodules @ 22-23 ft.

-CL- SANDY CLAY: Tan and yellowish brown, soft to very soft, with erosional silt and sand lenses throughout.

Sampler  
Types:Operation  
Types:

Notes:

Logger: Christian M. Lull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear



TETRA TECH

## LOG OF BORING B-6

Page  
2 of 2

Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: Former Brookings Property

Surface Elevation: 16.19

Borehole Number: B-6

Borehole  
Diameter (in.):

Date Started: 6/22/2013

Date Finished: 6/22/2013

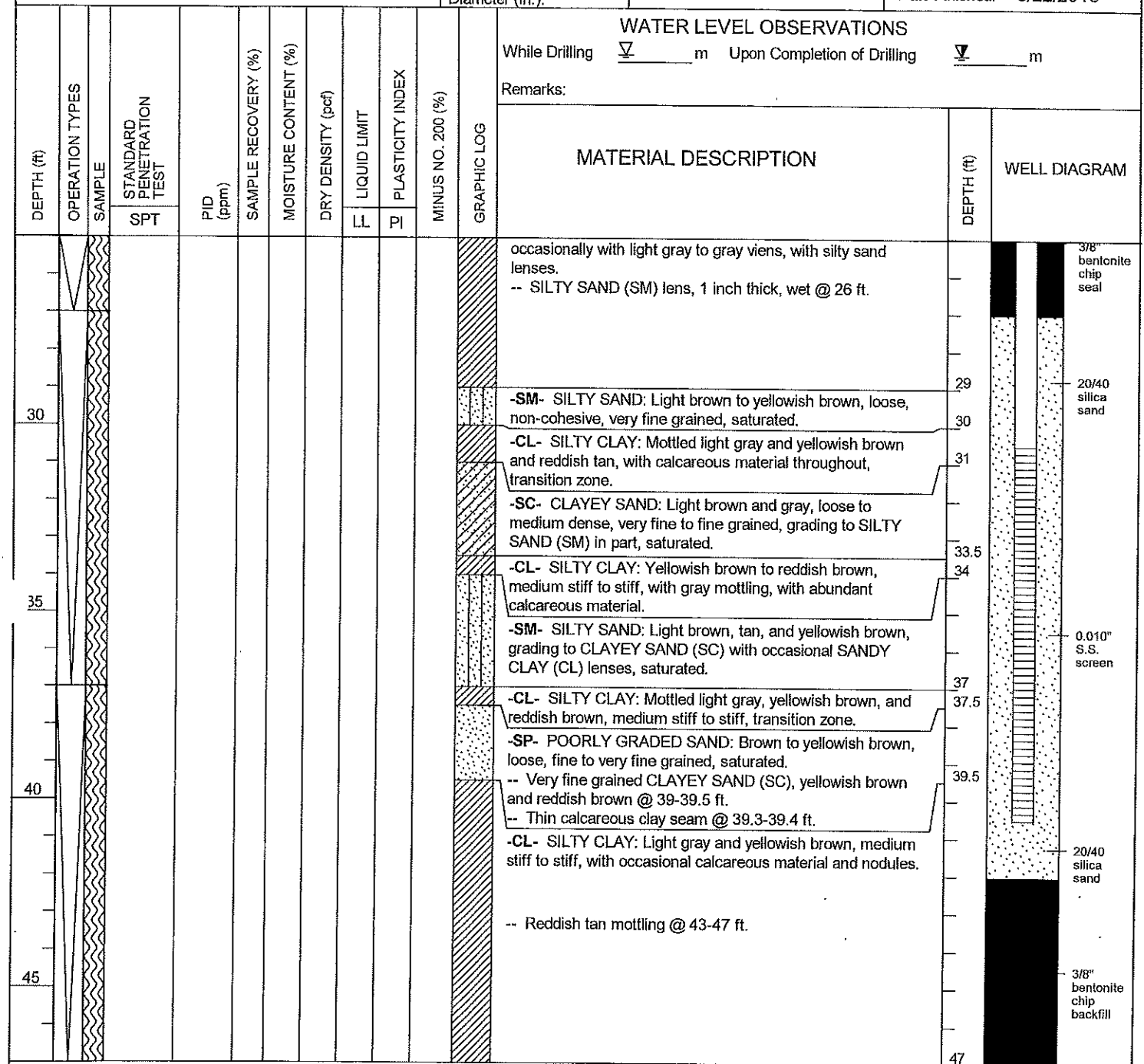
## WATER LEVEL OBSERVATIONS

While Drilling  $\nabla$  m Upon Completion of Drilling  $\nabla$  m

Remarks:

## MATERIAL DESCRIPTION

## WELL DIAGRAM



Bottom of borehole at 47.0 feet.

Sampler  
Types:Split  
Spoon

Shelby

Bulk  
SampleGrab  
Sample

Penetrometer



Vane Shear



California



Sonic

Operation  
Types:Mud  
RotaryContinuous  
Flight AugerWash  
Rotary

Auger



Air Rotary

Core  
BarrelDrive  
Casing

Notes:

Logger: Christian M. Lull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear



TETRA TECH

## LOG OF BORING B-7

Page  
1 of 2

Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: VCM Area

Surface Elevation: 19.85

Borehole Number: B-7

Borehole  
Diameter (in.):

Date Started: 6/20/2013

Date Finished: 6/20/2013

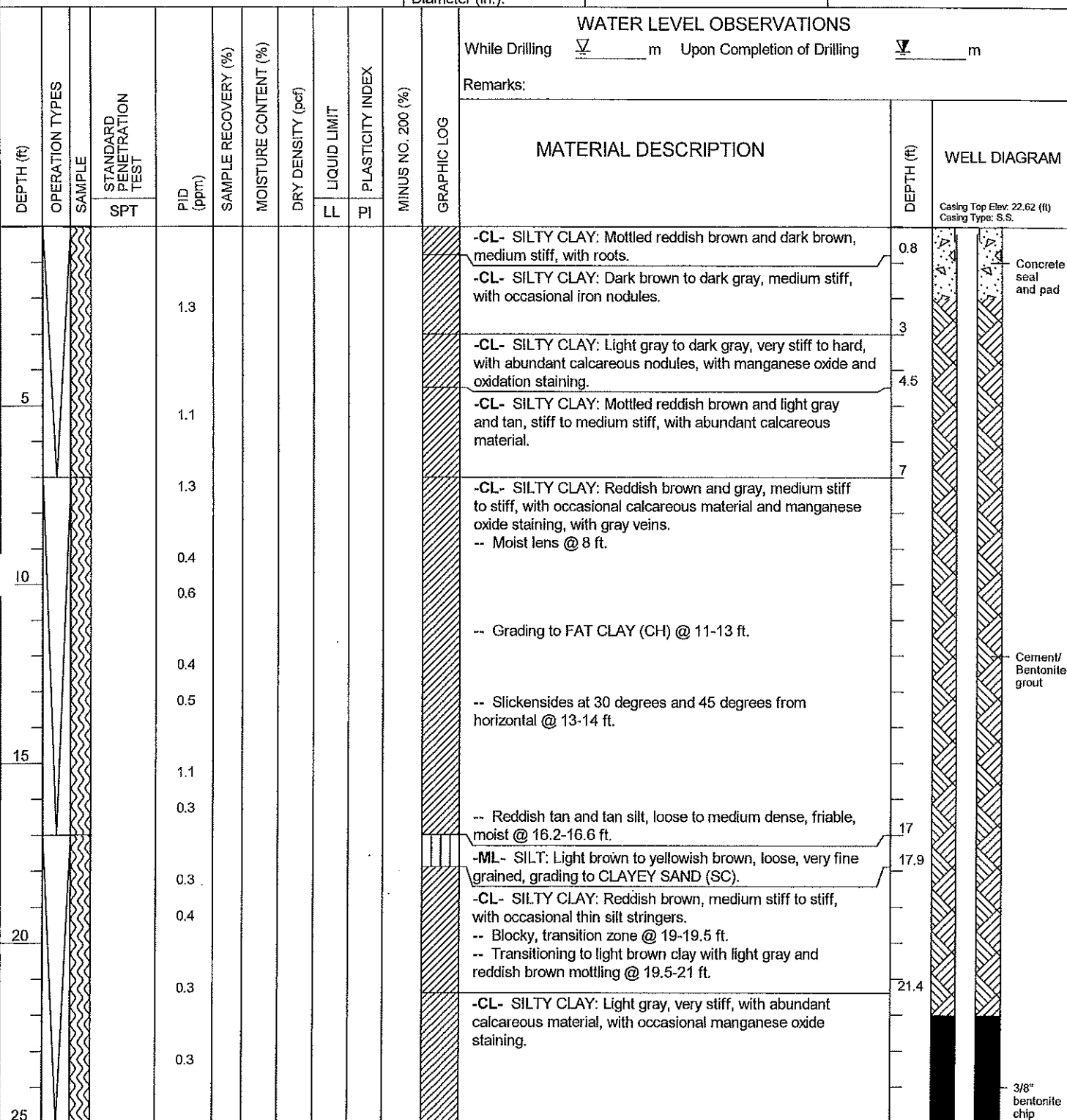
## WATER LEVEL OBSERVATIONS

While Drilling  $\nabla$  m Upon Completion of Drilling  $\nabla$  m

Remarks:

## MATERIAL DESCRIPTION

## WELL DIAGRAM

Casing Top Elev. 22.62 (ft)  
Casing Type: S.S.

Sampler Types:



Split Spoon



Shelby



Bulk Sample



Grab Sample



Penetrometer



Vane Shear



California



Sonic

Operation Types:



Mud Rotary



Continuous Flight Auger



Wash Rotary



Auger



Air Rotary



Core Barrel



Drive Casing

Notes:

Logger: Christian M. Llull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear

Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: VCM Area

Surface Elevation: 19.85

Borehole Number: B-7

Borehole  
Diameter (in.):

Date Started: 6/20/2013

Date Finished: 6/20/2013

## WATER LEVEL OBSERVATIONS

While Drilling  $\nabla$  m Upon Completion of Drilling  $\nabla$  m

Remarks:

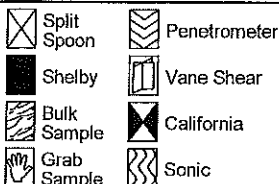
## MATERIAL DESCRIPTION

## WELL DIAGRAM

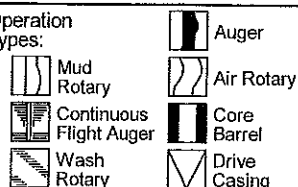
DEPTH (ft)	OPERATION TYPES	SAMPLE	STANDARD PENETRATION TEST	PID (ppm)	SAMPLE RECOVERY (%)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	LIQUID LIMIT	PLASTICITY INDEX	MINUS NO. 200 (%)	GRAPHIC LOG	DEPTH (ft)	WELL DIAGRAM
SPT								LL	PI				
30				0.2								25.5	seal
				0.1									
				0.1								29	20/40 silica sand
				0.1								30.5	
35				0.1								34.5	0.010" S.S. screen
				0.2									
				0.1								37	
				0.2								37.8	
40				0.2								39.5	20/40 silica sand
				0									
45				0.2								47	3/8" bentonite chip backfill

Bottom of borehole at 47.0 feet.

Sampler Types:



Operation Types:



Notes:

Logger: Christian M. Lull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear



TETRA TECH

## LOG OF BORING B-8

Page  
1 of 2

Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: VCM Area

Surface Elevation: 18.41

Borehole Number: B-8

Borehole  
Diameter (in.):

Date Started: 6/19/2013

Date Finished: 6/19/2013

## WATER LEVEL OBSERVATIONS

While Drilling  $\nabla$  m Upon Completion of Drilling  $\nabla$  m

Remarks:

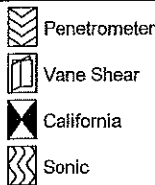
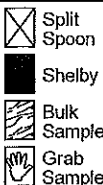
## MATERIAL DESCRIPTION

## WELL DIAGRAM

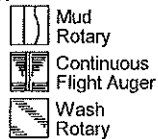
Casing Top Elev. 20.91 (ft)  
Casing Type: S.S.

DEPTH (ft)	OPERATION TYPES	SAMPLE	STANDARD PENETRATION TEST	PID (ppm)	SAMPLE RECOVERY (%)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	LIQUID LIMIT	PLASTICITY INDEX	MINUS NO. 200 (%)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	WELL DIAGRAM
			SPT					LL	PI					
												-CL- SILTY CLAY: Mottled light brown, tan, and gray, soft to medium stiff, with roots.	1.5	
				0								-CL- SILTY CLAY: Dark gray brown to dark gray, soft to medium stiff, with roots and organic matter, slightly moist, lighter with depth.	4	Concrete seal and pad
5				0								-CL- SILTY CLAY: Light brown and tan, medium stiff to stiff, slightly sandy in part, with organic lenses. -- Oxidized @ 5-6 ft.	6	
				0.3								-CL- SILTY CLAY: Light brown and tan, soft to medium stiff, friable, with abundant oxidation staining. -- Slightly sandy @ 7-8.3 ft.	8.3	
10				0.4								-ML- SILT: Light brown, tan, and yellowish brown, medium stiff to stiff, friable, with thin silty sand lenses and sandy clay streaks. -- Heavily oxidized, yellowish brown @ 10-11 ft. -- Dark orange brown SILTY SAND (SM) @ 11-12 ft.	13	
				0								-SC- CLAYEY SAND: Dark yellowish brown to orange brown, loose to medium dense, very fine grained.	14.5	
15				0								-SM- SILTY SAND: Light brown to light reddish tan, loose, very fine grained, saturated.	16.5	Cement/Bentonite grout
				0								-SM- SILTY SAND: Light brown to yellowish brown, loose, very fine grained, occasionally medium dense, interbedded. -- FAT CLAY (CH) layer @ 17.1-17.5 ft.	18.3	
20				0								-CL- SILTY CLAY: Light gray, medium stiff to very stiff, with abundant manganese oxide staining and calcareous nodules. -- Transition zone, fat reddish brown clays laminated with organic material, gray clay lenses, and oxidized sands @ 18.3-19 ft. -- Uniform, with abundant small calcareous nodules @ 20-23 ft.		
25				0								-- Slickenside @ 23.5 ft.		

Sampler Types:



Operation Types:



Notes:

Logger: Christian M. Lull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear



Date Finished: 6/19/2013

Bottom of borehole at 47.0 feet.

Notes:

Revised 5-18-12 (RHM)



Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: Former WWTP

Surface Elevation: 15.05

Borehole Number: D-45

Borehole  
Diameter (in.):

Date Started: 6/13/2013

Date Finished: 6/13/2013

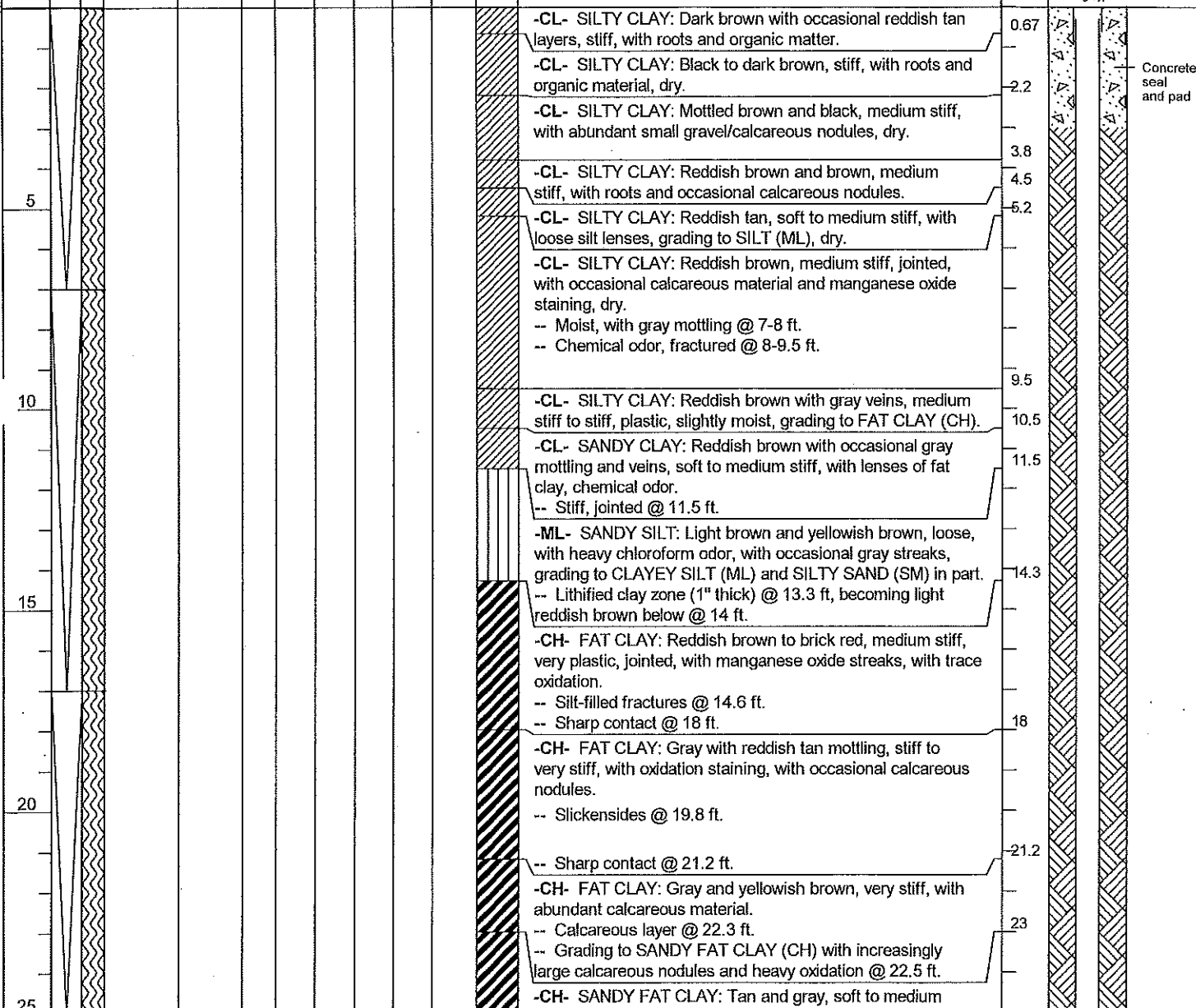
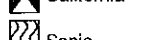
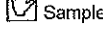
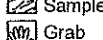
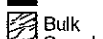
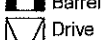
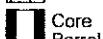
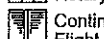
## WATER LEVEL OBSERVATIONS

While Drilling  $\nabla$  m Upon Completion of Drilling  $\nabla$  m

Remarks:

## MATERIAL DESCRIPTION

## WELL DIAGRAM

Casing Top Elev. 17.81 (ft)  
Casing Type: S.S.Sampler  
Types:Operation  
Types:

Notes:

Logger: Christian M. Lull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear



Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: Former WWTP

Surface Elevation: 15.05

Borehole Number: D-45

Borehole  
Diameter (in.):

Date Started: 6/13/2013

Date Finished: 6/13/2013

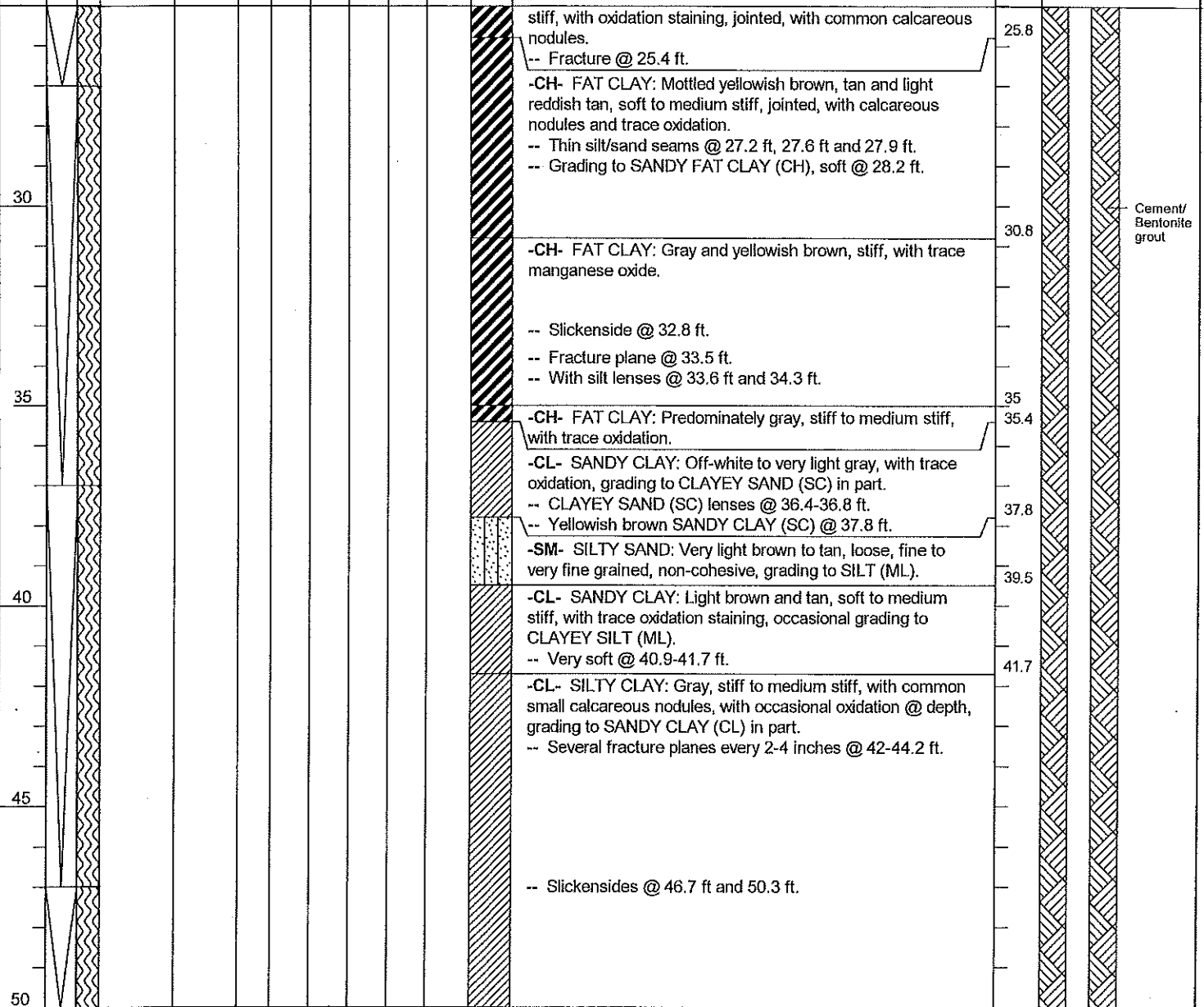
## WATER LEVEL OBSERVATIONS

While Drilling  $\nabla$  m Upon Completion of Drilling  $\nabla$  m

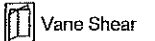
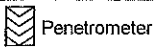
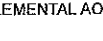
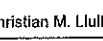
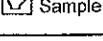
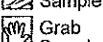
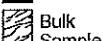
Remarks:

## MATERIAL DESCRIPTION

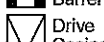
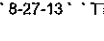
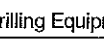
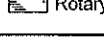
## WELL DIAGRAM



Sampler Types:



Operation Types:



Notes:

Logger: Christian M. Lull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear



Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: Former WWTP

Surface Elevation: 15.05

Borehole Number: D-45

Borehole  
Diameter (in.):

Date Started: 6/13/2013

Date Finished: 6/13/2013

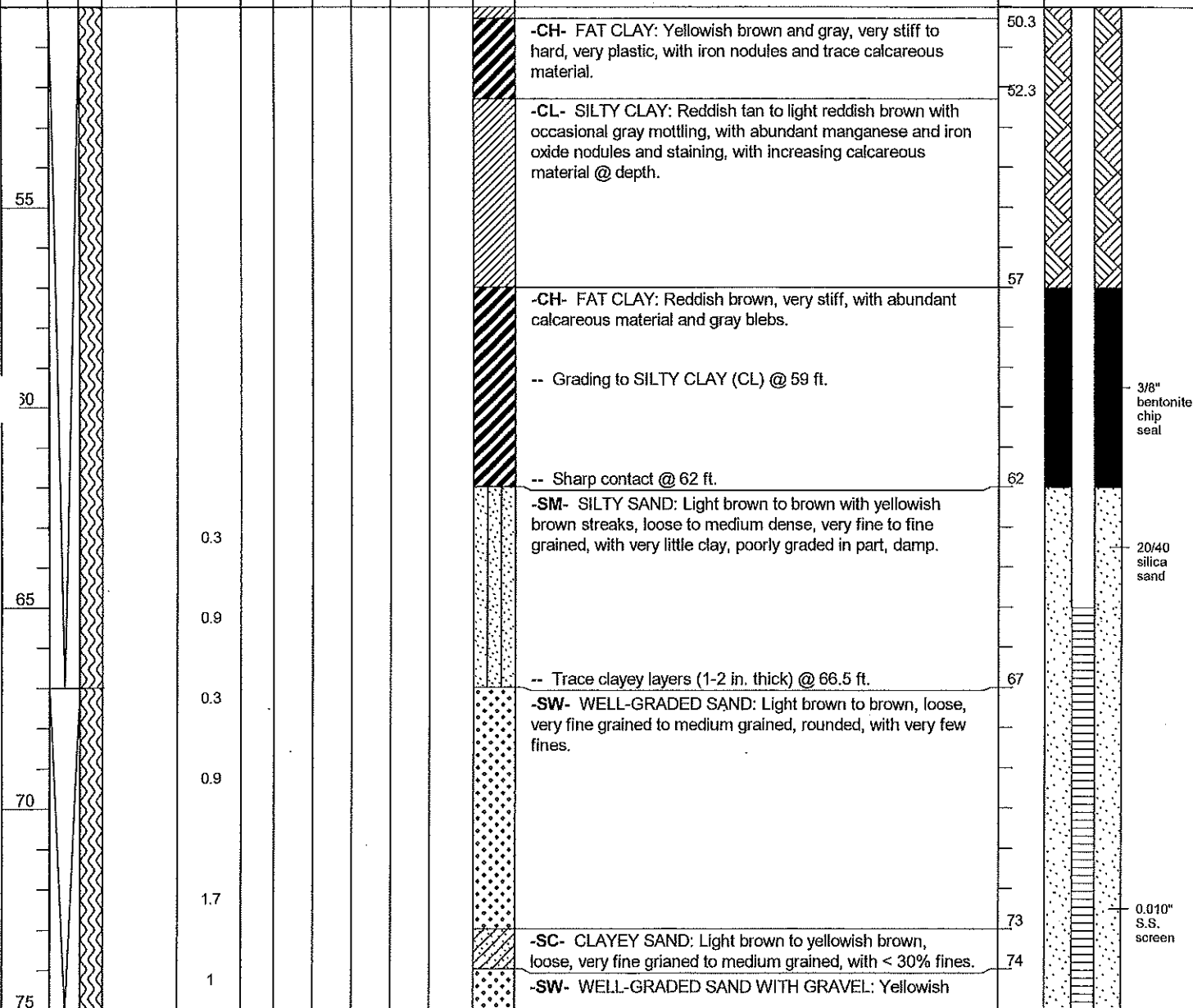
## WATER LEVEL OBSERVATIONS

While Drilling  $\nabla$  m Upon Completion of Drilling  $\nabla$  m

Remarks:

## MATERIAL DESCRIPTION

## WELL DIAGRAM



Sampler Types:	Split Spoon	Penetrometer	Operation Types:	Auger
	Shelby	Vane Shear		Air Rotary
	Bulk Sample	California		Core Barrel
	Grab Sample	Sonic		Drive Casing
			Mud Rotary	
			Continuous Flight Auger	
			Wash Rotary	

Notes:

Logger: Christian M. Llull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear



Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: Former WWTP

Surface Elevation: 15.05

Borehole Number: D-45

Borehole  
Diameter (in.):

Date Started: 6/13/2013

Date Finished: 6/13/2013

												WATER LEVEL OBSERVATIONS			
												While Drilling	▽ _____ m	Upon Completion of Drilling	▽ _____ m
												Remarks:			
DEPTH (ft)	OPERATION TYPES	SAMPLE	STANDARD PENETRATION TEST	PID (ppm)	SAMPLE RECOVERY (%)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	LIQUID LIMIT	PLASTICITY INDEX	MINUS NO. 200 (%)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	WELL DIAGRAM	
			SPT					LL	PI						
80				0.6								brown and brown, loose, coarse to medium grained, with coarse clay blebs, with dark gray organic zones, with small rounded gravel. -ML- CLAYEY SILT: Light tan, light brown and yellowish brown, loose, occasionally medium dense, with some light gray blebs. -- Grading to CLAYEY SAND (SC) @ 76.5-77.5 ft. -CL- SANDY CLAY: Light brown, medium stiff, with oxidation, with some reddish brown to tan blebs. -CH- SANDY FAT CLAY: Mottled gray and reddish tan, very stiff, with oxidized zones and common calcareous material, jointed.	75.8 76.7 79.5 82	 20/40 silica sand	

Bottom of borehole at 82.0 feet.

Sampler  
Types:Split  
Spoon

Penetrometer



Shelby



Vane Shear

Bulk  
Sample

California

Grab  
Sample

Sonic

Operation  
Types:

Auger

Mud  
Rotary

Air Rotary

Continuous  
Flight AugerCore  
BarrelWash  
RotaryDrive  
Casing

Notes:

Logger: Christian M. Lull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear



Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: Former WWTP

Surface Elevation: 18.36

Borehole Number: D-46

Borehole  
Diameter (in.):

Date Started: 6/15/2013

Date Finished: 6/15/2013

## WATER LEVEL OBSERVATIONS

While Drilling  $\nabla$  m Upon Completion of Drilling  $\nabla$  m

Remarks:

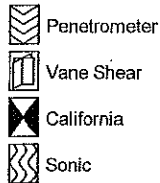
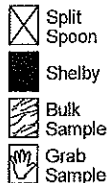
## MATERIAL DESCRIPTION

## WELL DIAGRAM

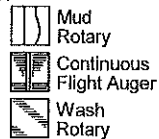
Casing Top Elev. 20.94 (ft)  
Casing Type: S.S.

DEPTH (ft)	OPERATION TYPES	SAMPLE	STANDARD PENETRATION TEST	PID (ppm)	SAMPLE RECOVERY (%)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	LIQUID LIMIT	PLASTICITY INDEX	MINUS NO. 200 (%)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	WELL DIAGRAM
			SPT					LL	PI					
				0								-CL- SILTY CLAY: Dark brown, medium stiff to stiff, with roots, with small to medium gravel.	1	
												-CL- SILTY CLAY: Mottled reddish tan and dark gray, medium stiff, with roots common.	2	
												-CL- SILTY CLAY: Dark gray, soft, with trace small gravel, moist.		
5				0								-- Stiffer with depth and dry, occasionally medium stiff to very stiff @ 4 ft.	5.1	
				0								-CL- SILTY CLAY: Brown to gray brown, medium stiff to very stiff, with iron nodules and small gravel.	6.1	
												-CL- SILTY CLAY: Reddish brown, medium stiff to stiff, slightly to medium plastic, jointed, with silt lenses.		
10				0								-- Slightly moist @ 7-8 ft.		
				0								-- Grading to SILT (ML) @ 9.5 ft.		
				0								-- Very fine grained SANDY SILT (ML) layer @ 10-10.5 ft.		
				0								-- Becoming light reddish brown, with manganese oxide staining, blocky @ 11 ft.		
15				0								-CH- FAT CLAY: Reddish brown, medium stiff to stiff, very plastic, with calcareous veins and manganese oxide staining.	14	
				0								-ML- CLAYEY SILT: Reddish tan, very fine grained.	45.2	
												-- Grading to SANDY CLAY (CL) @ 15.8 ft.	16.3	
				0								-ML- SANDY SILT: Light reddish brown to yellowish brown, loose to medium dense, with occasional clay blebs, grading to SANDY CLAY (CL) in part.		
20				0								-- SANDY CLAY (CL) layer @ 18.8-19.3 ft.	19.3	
												-SM- SILTY SAND: Light brown to yellowish brown, loose, very fine grained, moist, slightly clayey in part.	20.7	
				0								-- Sharp contact @ 20.7 ft.		
												-CH- FAT CLAY: Reddish brown, soft to medium stiff, jointed, very plastic, with manganese oxide staining.		
25				0								-CH- FAT CLAY: Reddish tan with gray mottling, stiff to very stiff, with occasional manganese oxide staining.	23.5	
												-- Fracture plane @ 23.6 ft.		

Sampler Types:



Operation Types:



Notes:

Logger: Christian M. Lull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear



Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: Former WWTP

Surface Elevation: 18.36

Borehole Number: D-46

Borehole  
Diameter (in.):

Date Started: 6/15/2013

Date Finished: 6/15/2013

## WATER LEVEL OBSERVATIONS

While Drilling  $\nabla$  m Upon Completion of Drilling  $\nabla$  m

Remarks:

## MATERIAL DESCRIPTION

## WELL DIAGRAM

DEPTH (ft)	OPERATION TYPES	SAMPLE	STANDARD PENETRATION TEST	PID (ppm)	SAMPLE RECOVERY (%)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	LIQUID LIMIT	PLASTICITY INDEX	MINUS NO. 200 (%)	GRAPHIC LOG	DEPTH (ft)	WELL DIAGRAM
SPT								LL	PI				
0				0								25.5	
0				0									
0				0									
30				0									
0				0								31.1	
0				0								31.6	
0				0									
35				0									
0				0								34.9	
0				0									
40				0									
0				0								39.8	
0				0									
45				0								42	
0				0									
0				0								45.5	
0				0									
50				0									
0				0								49.7	

-CL- SANDY CLAY: Gray, medium stiff, occasionally soft, with abundant calcareous nodules, with trace oxidation and manganese oxide staining.

-- Moist @ 27.8-28.2 ft.

-- Increased oxidation @ 28.5 ft.

-- Grading to CLAYEY SILT (ML) @ 28.8-29.4 ft and 29.9-30.6 ft.

-ML- SILT: Light brown with gray streaks, loose, sandy.

-SM- SILTY SAND: Light brown, loose, very fine grained to fine grained, non-cohesive, wet, grading to CLAYEY SAND (SC).

-CL- SANDY CLAY: Light gray, light brown and light reddish tan, soft to medium stiff, with occasional oxidation, jointed.

-- Interbedded with sand lenses @ 37-38 ft.

-- Heavily oxidized @ 38-39 ft.

-SC- CLAYEY SAND: Light brown to yellowish brown, loose to medium dense, oxidized @ depth.

-- Grading to SILTY SAND (SM) @ 41 ft.

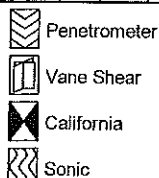
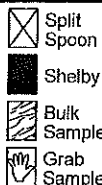
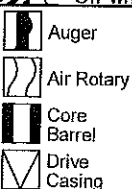
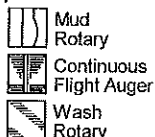
-SM- SILTY SAND: Off-white to very light gray, loose to medium dense, very fine grained, interbedded with silts and clays throughout, darker with depth, occasionally grading to SANDY CLAY (CL) and SANDY SILT (ML).

-SM- SILTY SAND: Light brown to yellowish brown, loose to medium dense, fine grained to very fine grained, uniform, slightly clayey.

-- Predominately light brown @ 47-49 ft.

-- Medium stiff clay layer @ 49-49.3 ft.

-- Off-white to light gray @ 49.3-49.7 ft.

Cement/  
Bentonite  
groutSampler  
Types:Operation  
Types:

Notes:

Logger: Christian M. Lull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear



TETRA TECH

## LOG OF BORING D-46

Page  
3 of 4

Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: Former WWTP

Surface Elevation: 18.36

Borehole Number: D-46

Borehole  
Diameter (in.):

Date Started: 6/15/2013

Date Finished: 6/15/2013

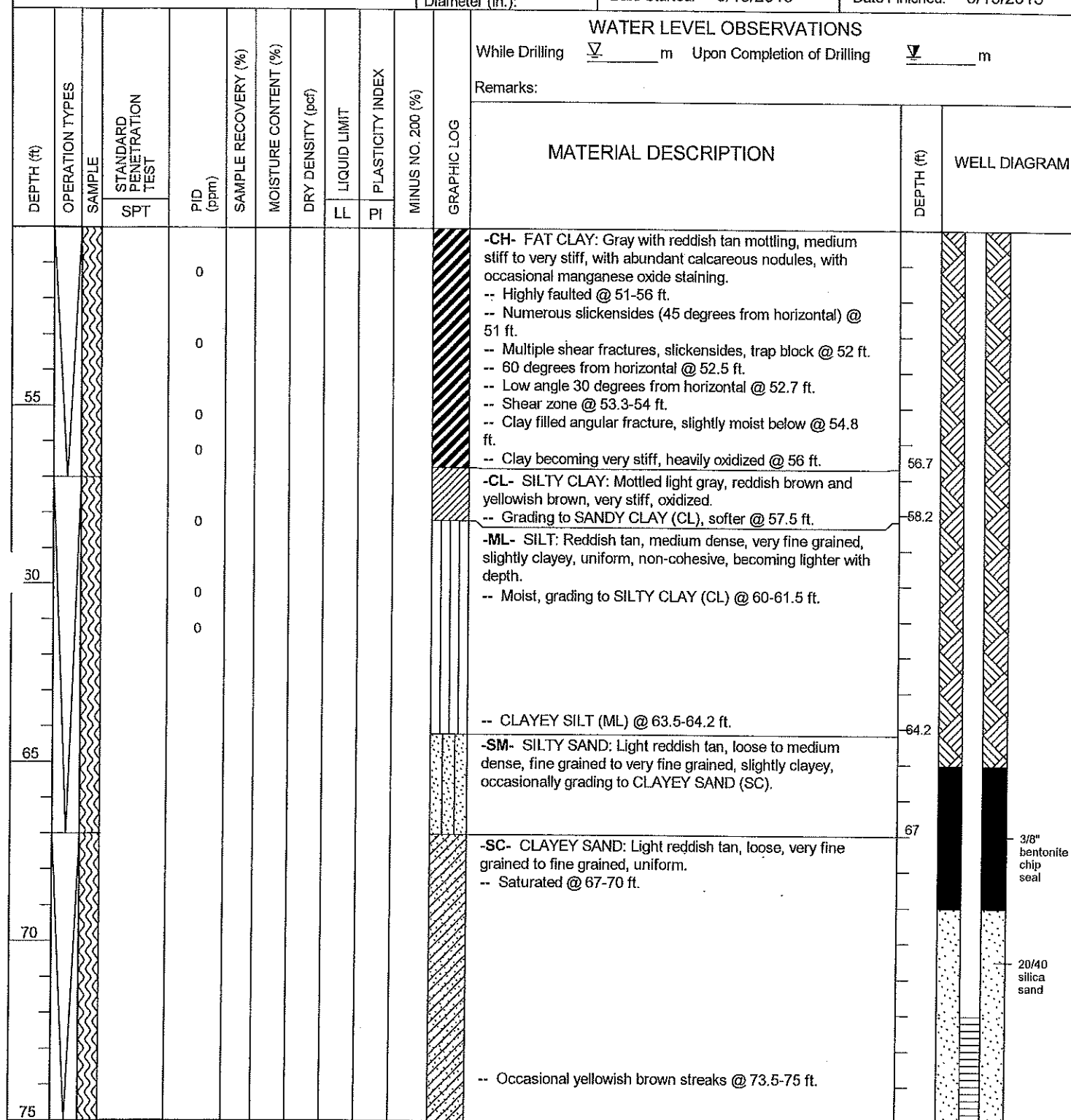
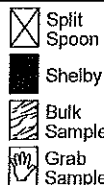
## WATER LEVEL OBSERVATIONS

While Drilling  $\nabla$  m Upon Completion of Drilling  $\nabla$  m

Remarks:

## MATERIAL DESCRIPTION

## WELL DIAGRAM

Sampler  
Types:Operation  
Types:

Auger

Air Rotary

Core Barrel

Drive Casing

Notes:

Logger: Christian M. Lull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear





TETRA TECH

## LOG OF BORING D-46

Page  
4 of 4

Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: Former WWTP

Surface Elevation: 18.36

Borehole Number: D-46

Borehole  
Diameter (in.):

Date Started: 6/15/2013

Date Finished: 6/15/2013

## WATER LEVEL OBSERVATIONS

While Drilling  $\nabla$  m Upon Completion of Drilling  $\nabla$  m

Remarks:

## MATERIAL DESCRIPTION

DEPTH (ft)

## WELL DIAGRAM

-- SANDY CLAY (CL) lenses with small gravel @ 76-76.5 ft.

-SP- POORLY GRADED SAND: Light brown, tan and yellowish brown, loose, very fine grained.

-CH- FAT CLAY: Reddish brown, stiff, very plastic, with layers of light brown, loose, very fine grained SILT (ML).

Bottom of borehole at 82.0 feet.

Sampler  
Types:Split  
Spoon

Shelby

Bulk  
SampleGrab  
Sample

Penetrometer



Vane Shear



California



Sonic

Operation  
Types:Mud  
RotaryContinuous  
Flight AugerWash  
Rotary

Auger



Air Rotary

Core  
BarrelDrive  
Casing

Notes:

Logger: Christian M. Llull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear



TETRA TECH

## LOG OF BORING D-47

Page  
1 of 5

Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: VCM Area

Surface Elevation: 20.41

Borehole Number: D-47

Borehole  
Diameter (in.):

Date Started: 6/18/2013

Date Finished: 6/18/2013

## WATER LEVEL OBSERVATIONS

While Drilling  $\nabla$  m Upon Completion of Drilling  $\nabla$  m

Remarks:

## MATERIAL DESCRIPTION

## WELL DIAGRAM

Casing Top Elev: 23.47 (ft)  
Casing Type: S.S.

-CL- SILTY CLAY: Dark brown, soft, organic.

-ML- SILT: Dark brown to light brown, loose, slightly clayey.

-CL- SILTY CLAY: Light brown with yellowish brown and orange brown mottling, very stiff, with occasional manganese oxide staining.

-CL- SILTY CLAY: Reddish brown, very stiff, slightly sandy, laminated with occasional gray lenses.

-CL- SILTY CLAY: Reddish brown, stiff to very stiff, with occasional manganese oxide staining and calcareous material.

-- Abundant calcareous material @ 6-7 ft.

-CL- SILTY CLAY: Reddish brown, soft to medium stiff, with abundant calcareous material.

-- Moist, very soft @ 7.5-8.5 ft.

-- Very stiff @ 10.5-11.5 ft.

-- Moist CLAYEY SAND (SC) layer @ 11.5-12.5 ft.

-CH- FAT CLAY: Reddish brown, stiff to very stiff, with occasional manganese oxide staining, medium to very plastic, with calcareous nodules.

-- Occasional gray veins @ 17-18 ft.

-- Blocky @ 19-20 ft.

-- Becoming SILTY CLAY (CL) @ 20-22 ft.

-CL- SILTY CLAY: Light brown to light yellowish brown, with occasional light reddish tan mottling, medium stiff to stiff, with manganese oxide and calcareous material, occasionally fat in part.

-CL- SANDY CLAY: Light brown to light yellowish brown,

Sampler  
Types:Split  
Spoon

Penetrometer



Shelby



Vane Shear

Bulk  
Sample

California

Grab  
Sample

Sonic

Operation  
Types:

Auger

Mud  
RotaryContinuous  
Flight AugerWash  
Rotary

Air Rotary

Core  
BarrelDrive  
Casing

Notes:

Logger: Christian M. Liuli

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear



TETRA TECH

## LOG OF BORING D-47

Page  
2 of 5

Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: VCM Area

Surface Elevation: 20.41

Borehole Number: D-47

Borehole  
Diameter (in.):

Date Started: 6/18/2013

Date Finished: 6/18/2013

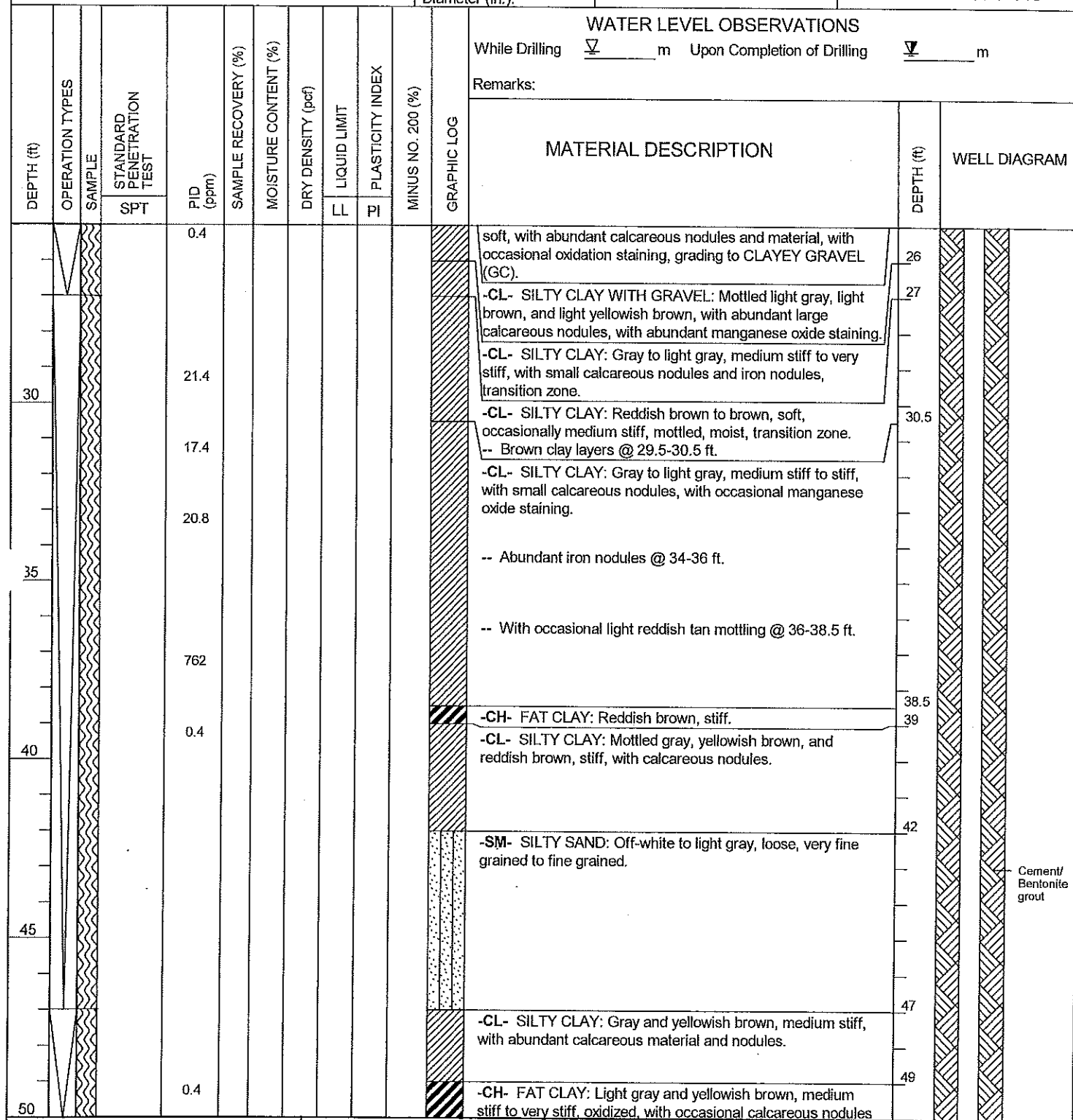
## WATER LEVEL OBSERVATIONS

While Drilling  $\nabla$  m Upon Completion of Drilling  $\nabla$  m

Remarks:

## MATERIAL DESCRIPTION

## WELL DIAGRAM

Cement/  
Bentonite  
grout

Sampler Types:

- ☒ Split Spoon
- ☒ Shelby
- ☒ Bulk Sample
- ☒ Grab Sample
- ☒ Penetrometer
- ☒ Vane Shear
- ☒ California
- ☒ Sonic

Operation Types:

- ☒ Mud Rotary
- ☒ Continuous Flight Auger
- ☒ Wash Rotary
- ☒ Auger
- ☒ Air Rotary
- ☒ Core Barrel
- ☒ Drive Casing

Notes:

Logger: Christian M. Lull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear



TETRA TECH

## LOG OF BORING D-47

Page  
3 of 5

Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: VCM Area

Surface Elevation: 20.41

Borehole Number: D-47

Borehole  
Diameter (in.):

Date Started: 6/18/2013

Date Finished: 6/18/2013

## WATER LEVEL OBSERVATIONS

While Drilling  $\nabla$  m Upon Completion of Drilling  $\nabla$  m

Remarks:

## MATERIAL DESCRIPTION

## WELL DIAGRAM

DEPTH (ft)	OPERATION TYPES	SAMPLE	STANDARD PENETRATION TEST	PID (ppm)	SAMPLE RECOVERY (%)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	LIQUID LIMIT	PLASTICITY INDEX	MINUS NO. 200 (%)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	WELL DIAGRAM
55			SPT	0.6								and manganese oxide staining.		
				0.8								-- Slickensides @ 51.5 ft.		
				33.4								-- Heavily fractured zone @ 53-57 ft.		
				0								-- Slickensides @ 54.5 ft, 56.5 ft, and 59.3 ft.		
30				0.8										
				1.1								-- Increased calcareous material @ 60 ft.		
				0.5								-- Becoming silty, with reddish tan mottling @ 61 ft.	61	
65				0								-CL- SILTY CLAY: Light gray to yellowish brown, medium stiff to stiff, with trace manganese oxide staining and nodules, with reddish tan mottling, with slickensides at 6-inch spacing.		
				0								-- Highly faulted @ 61.5-66.5 ft.		
				3.4								-- Softer and sandier, with predominant reddish tan and gray clay @ 67-68 ft.	68	
70				0								-CL- SILTY CLAY: Reddish brown, medium stiff, micaceous.		
												-CL- SANDY CLAY: Reddish brown to reddish tan, soft, with very fine grained sand throughout, grading to CLAYEY SAND (SC).	70.5	
												-CL- SILTY CLAY: Reddish brown, soft to medium stiff, with SANDY CLAY (CL) layers.	72.5	
												-- Soft, moist @ 73.5-74.5 ft.		
75														

Sampler Types:



Operation Types:



Notes:

Logger: Christian M. Llull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear



TETRA TECH

## LOG OF BORING D-47

Page  
4 of 5

Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: VCM Area

Surface Elevation: 20.41

Borehole Number: D-47

Borehole  
Diameter (in.):

Date Started: 6/18/2013

Date Finished: 6/18/2013

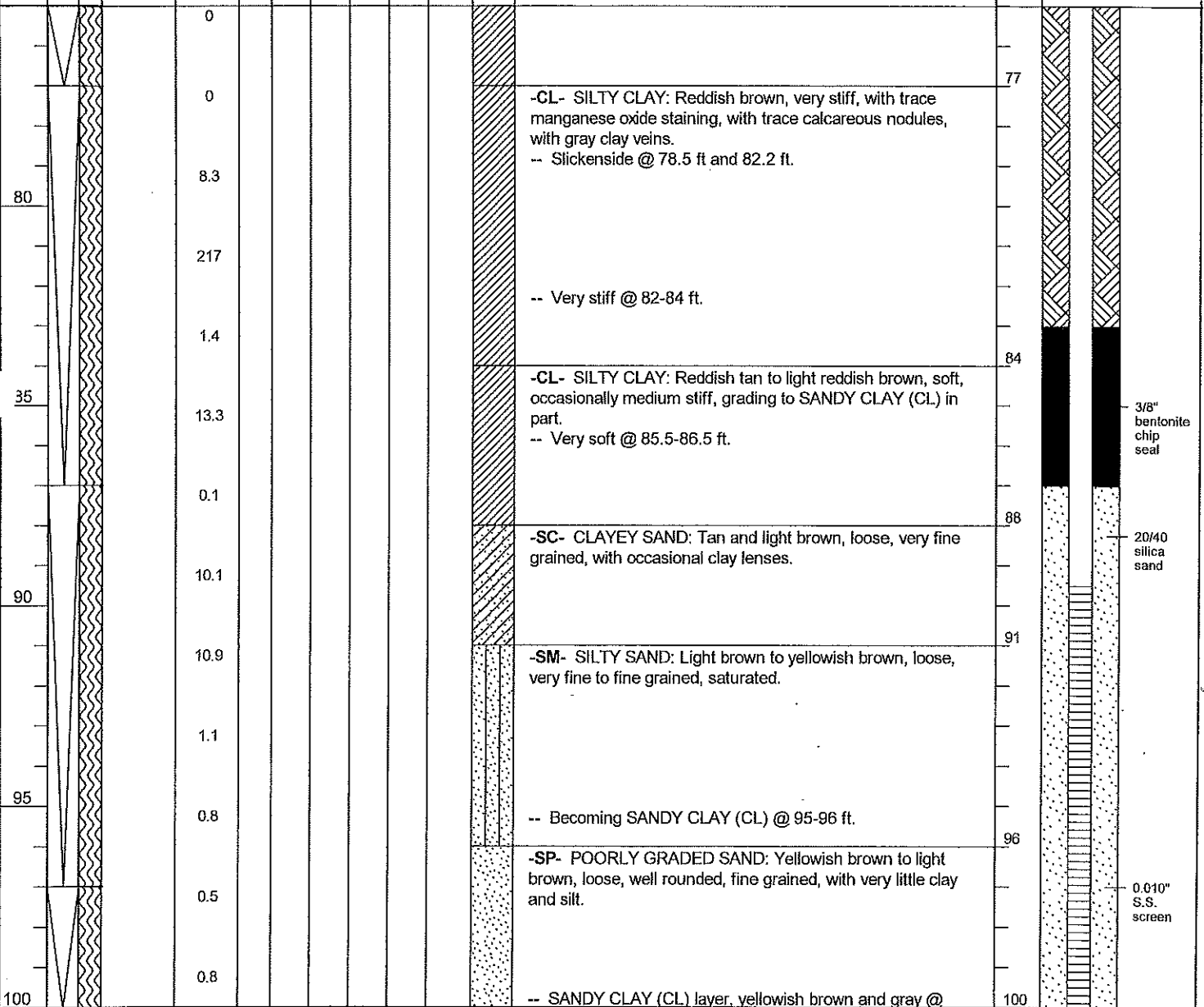
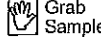
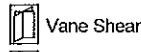
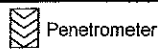
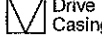
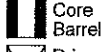
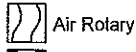
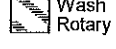
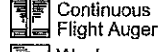
## WATER LEVEL OBSERVATIONS

While Drilling  $\nabla$  m Upon Completion of Drilling  $\nabla$  m

Remarks:

## MATERIAL DESCRIPTION

## WELL DIAGRAM

Sampler  
Types:Operation  
Types:

Notes:

Logger: Christian M. Llull

Drilling Equipment:

Sonic Rig 128

Contractor:

Boart Longyear



Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: VCM Area

Surface Elevation: 20.41

Borehole Number: D-47

Borehole  
Diameter (in.):

Date Started: 6/18/2013

Date Finished: 6/18/2013

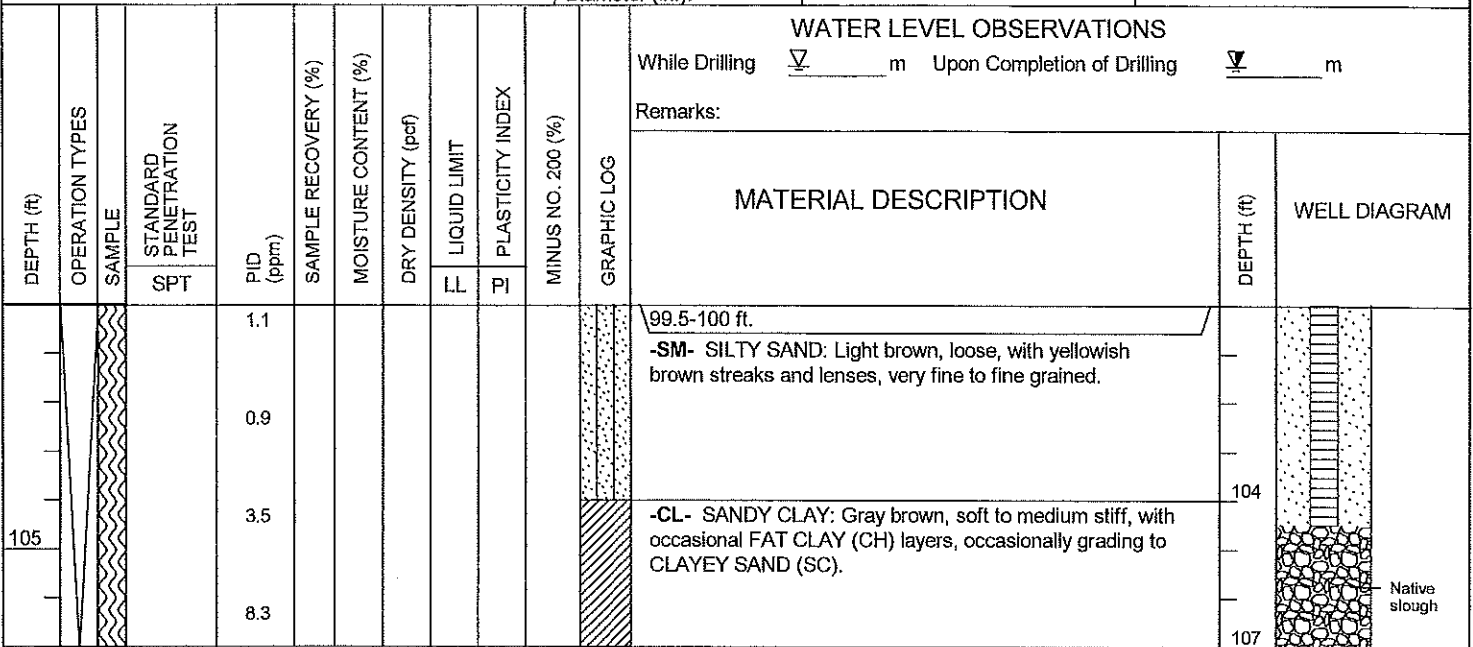
## WATER LEVEL OBSERVATIONS

While Drilling    m Upon Completion of Drilling    m

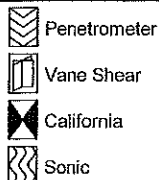
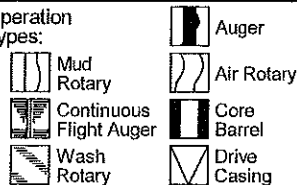
Remarks:

## MATERIAL DESCRIPTION

## WELL DIAGRAM



Bottom of borehole at 107.0 feet.

Sampler  
Types:Operation  
Types:

Notes:

Logger: Christian M. Llull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear



Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: Former Brookings Property

Surface Elevation: 17.6

Borehole Number: P-61

Borehole  
Diameter (in.):

Date Started: 6/22/2013

Date Finished: 6/22/2013

## WATER LEVEL OBSERVATIONS

While Drilling    m Upon Completion of Drilling    m

Remarks:

## MATERIAL DESCRIPTION

## WELL DIAGRAM

Casing Top Elev. 20.31 (ft)  
Casing Type: S.S.

-CL- SILTY CLAY: Dark brown to dark gray brown, medium stiff, with occasional roots and organic material.

-- Abundant calcareous nodules @ 1.5-2 ft.

-CL- SILTY CLAY: Light brown and tan, with occasional gray, very stiff, with calcareous material and mottling throughout.

-CL- SILTY CLAY: Reddish tan to reddish brown, stiff, with calcareous material and silt lenses.

-- Blocky, with gray mottling and manganese oxide staining, dry @ 6-7 ft.

-- Thin weathered yellowish brown layer, dry @ 11.5-11.7 ft.

-CH- FAT CLAY: Reddish brown, medium stiff to stiff, with occasional gray veins, calcareous lenses common.

-- Erosional surface @ 13.5 ft.

-- Heavily cemented calcareous zone @ 13.8-14.5 ft.

-CL- SANDY CLAY: Reddish tan to light brown, soft, with trace gray mottling and trace wood detritus.

-SM- SILTY SAND: Light brown, loose, non-cohesive, very fine grained, with trace yellowish brown streaks, saturated.

-CL- SILTY CLAY: Reddish brown with reddish tan streaks, medium stiff to stiff, with abundant manganese oxide staining, with abundant calcareous material.

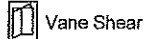
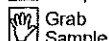
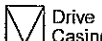
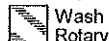
-- Heavily oxidized @ 19-19.5 ft.

-- Erosional contact, heavily cemented calcareous zone @ 20-20.2 ft.

-CL- SILTY CLAY: Light gray, medium stiff to very stiff, with abundant small calcareous nodules, with occasional reddish tan streaks and lenses.

-- Erosional surface, increased reddish tan streaks @ 20.2-21.2 ft.

Bottom of borehole at 22.0 feet.

Sampler  
Types:Operation  
Types:

Notes:

Logger: Christian M. Lull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear



Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: Former Brookings Property

Surface Elevation: 18.83

Borehole Number: P-62

Borehole  
Diameter (in.):

Date Started: 6/21/2013

Date Finished: 6/21/2013

## WATER LEVEL OBSERVATIONS

While Drilling  $\nabla$  m Upon Completion of Drilling  $\nabla$  m

Remarks:

## MATERIAL DESCRIPTION

## WELL DIAGRAM

Casing Top Elev. 21.66 (ft)  
Casing Type: S.S.

-CL- SILTY CLAY: Dark brown to black, medium stiff to stiff, with roots and organic matter.

-CL- SILTY CLAY: Light brown and tan, medium stiff to stiff, with abundant calcareous material.

-CL- SILTY CLAY: Reddish brown, medium stiff, with occasional gray mottling, with occasional thin silt stringers, with occasional calcareous material.  
-- Yellowish brown clay layer @ 7.5-8 ft.  
-- Reddish tan @ 8-9 ft.

-- SILT (ML) @ 10-11 ft.

-- Softer @ 11-12 ft.

-CL- SILTY CLAY: Reddish brown to reddish tan, medium stiff, with occasional gray mottling, blocky, with occasional manganese oxide staining.  
-- Sandy clay stringers (1/4 inch thick) @ 12.8 ft, 14 ft, and 15.2 ft.-SM- SILTY SAND: Reddish tan, loose, very fine grained, moist to saturated, grading to SANDY CLAY (CL).  
-- More clayey, grading to CLAYEY SAND (SC) @ 17-17.5 ft.

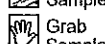
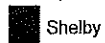
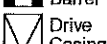
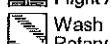
-CL- SILTY CLAY: Reddish brown, medium stiff, with gray mottling, with abundant manganese oxide staining, jointed, waxy.

-CL- SILTY CLAY: Yellow brown to reddish tan, very stiff to hard, with occasional gray veins, with abundant calcareous material.

-- Mottled with gray @ 20.3-21 ft.

-- Thin shell fragment layer, calcareous cemented, slightly moist @ 20.3-21 ft.

Bottom of borehole at 22.0 feet.

Sampler  
Types:Operation  
Types:

Notes:

Logger: Christian M. Liull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear





Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: Former WWTP

Surface Elevation: 22.06

Borehole Number: P-63

Borehole  
Diameter (in.):

Date Started: 6/17/2013

Date Finished: 6/17/2013

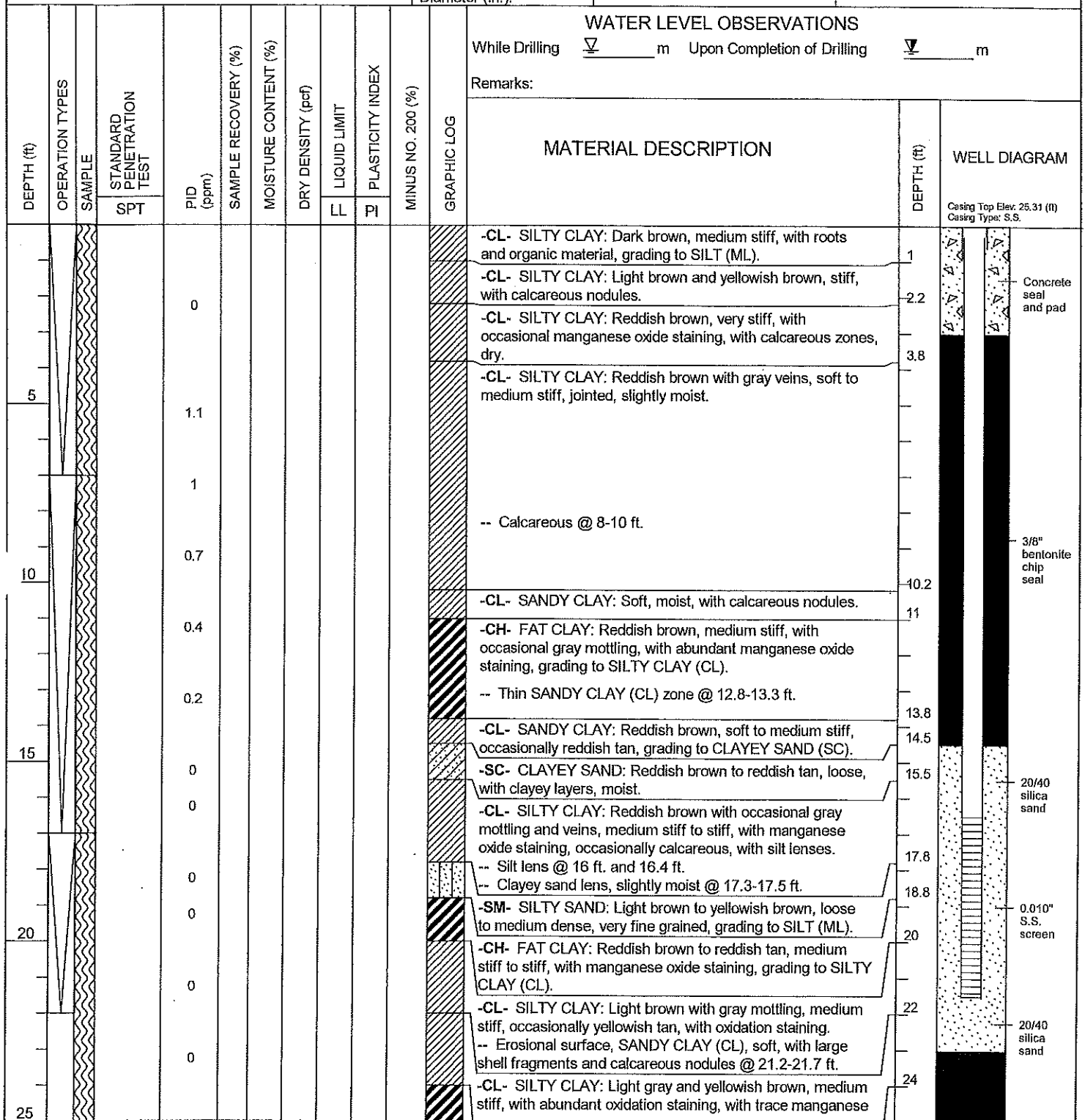
## WATER LEVEL OBSERVATIONS

While Drilling  $\nabla$  m Upon Completion of Drilling  $\nabla$  m

Remarks:

## MATERIAL DESCRIPTION

## WELL DIAGRAM

Sampler  
Types:Split  
Spoon

Shelby

Bulk  
SampleGrab  
Sample

Penetrometer



Vane Shear



California



Sonic

Operation  
Types:Mud  
RotaryContinuous  
Flight AugerWash  
Rotary

Auger



Air Rotary

Core  
BarrelDrive  
Casing

Notes:

Logger: Christian M. Lull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear



TETRA TECH

## LOG OF BORING P-63

Page  
2 of 2

Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: Former WWTP

Surface Elevation: 22.06

Borehole Number: P-63

Borehole  
Diameter (in.):

Date Started: 6/17/2013

Date Finished: 6/17/2013

## WATER LEVEL OBSERVATIONS

While Drilling    m Upon Completion of Drilling    m

Remarks:

## MATERIAL DESCRIPTION

DEPTH (ft)

WELL DIAGRAM

oxide staining, occasionally soft, grading to SANDY CLAY (CL).

-CH- SANDY FAT CLAY: Light gray, soft to medium stiff, with small to medium calcareous nodules, grading to SANDY CLAY (CL).

Bottom of borehole at 27.0 feet.

3/8" bentonite chip backfill

Sampler Types:



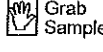
Penetrometer



Vane Shear



California



Sonic

Operation Types:



Mud Rotary



Continuous Flight Auger



Wash Rotary



Auger



Air Rotary



Core Barrel



Drive Casing

Notes:

Logger: Christian M. Lull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear



Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: VCM Area

Surface Elevation: 19.68

Borehole Number: P-64

Borehole  
Diameter (in.):

Date Started: 6/17/2013

Date Finished: 6/17/2013

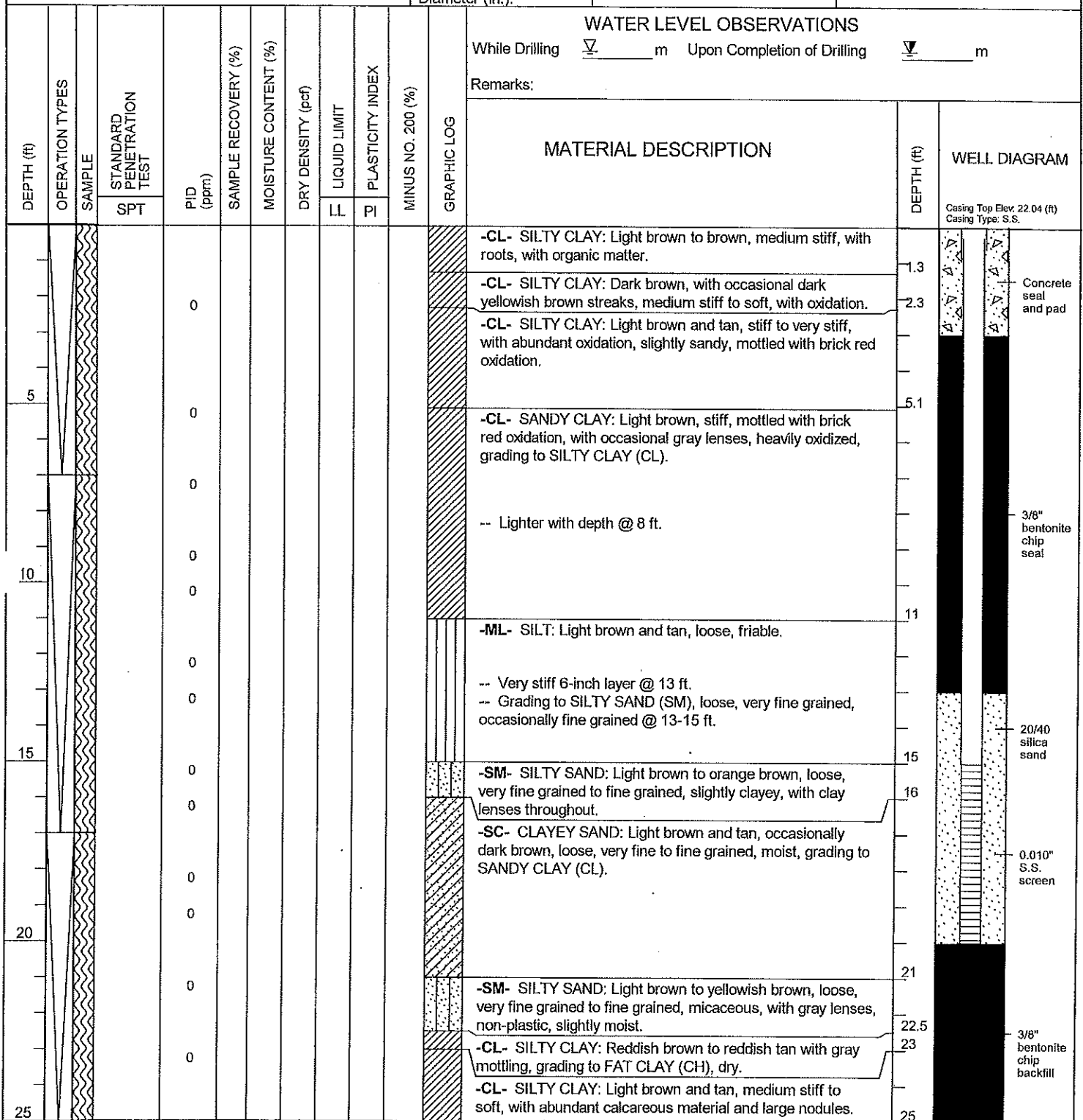
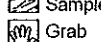
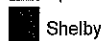
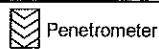
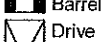
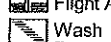
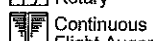
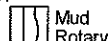
## WATER LEVEL OBSERVATIONS

While Drilling  $\nabla$  \_\_\_\_\_ m Upon Completion of Drilling  $\nabla$  \_\_\_\_\_ m

Remarks:

## MATERIAL DESCRIPTION

## WELL DIAGRAM

Casing Top Elev. 22.04 (ft)  
Casing Type: S.S.Sampler  
Types:Operation  
Types:Notes:  
Bottom of borehole at 25.0 feet.

Logger: Christian M. Lull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear

Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: VCM Area

Surface Elevation: 20.48

Borehole Number: P-65

Borehole  
Diameter (in.):

Date Started: 6/17/2013

Date Finished: 6/17/2013

**WATER LEVEL OBSERVATIONS**

While Drilling    m Upon Completion of Drilling    m

Remarks:

**MATERIAL DESCRIPTION**

**WELL DIAGRAM**

DEPTH (ft)	OPERATION TYPES	SAMPLE	STANDARD PENETRATION TEST	PID (ppm)	SAMPLE RECOVERY (%)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	LIQUID LIMIT	PLASTICITY INDEX	MINUS NO. 200 (%)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	WELL DIAGRAM
			SPT					LL	PI					
0				0								-ML- SILT: Light brown, loose, with roots, dry. -- Brown @ 0.8-1.5 ft.	1.5	Concrete seal and pad
2.5												-CL- SILTY CLAY: Yellowish brown and light gray, stiff to very stiff, with abundant oxidation. -- Hard @ 2-2.5 ft.	2.5	
5				0								-CL- SILTY CLAY: Reddish brown, very stiff to hard, with calcareous material and silt lenses throughout. -- Moist and softer @ 4-6.5 ft.	7.5	
7.5				0								-CL- SANDY CLAY: Reddish brown, soft, moist, with calcareous zones, grading to CLAYEY SAND (SC).	9.2	3/8" bentonite chip seal
10				0								-CH- FAT CLAY: Reddish brown, stiff to very stiff, with occasional gray mottling and veins, with trace manganese oxide staining and calcareous nodules.	13	
13				0								-CL- SANDY CLAY: Reddish tan, grading to CLAYEY SAND (SC) in part, moist, micaceous, with very fine grained sand. -- Saturated @ 14 ft.	15	20/40 silica sand
15				0								-CL- SILTY CLAY: Reddish brown, medium stiff to very stiff, jointed, with trace gray mottling and calcareous material, grading to FAT CLAY (CH).	18.3	
18.3				0								-SC- CLAYEY SAND: Reddish tan, loose, very fine grained, with lenses of sandy clay interbedded, grading to SANDY SILT (ML).	19.5	0.010" S.S. screen
19.5				0								-CL- SANDY CLAY: Reddish brown fat clay lenses, and reddish tan clayey sand layers. -- CLAYEY SAND (SC) layer @ 20.2-20.5 ft.	20.5	
20.5				0								-CL- SILTY CLAY: Reddish brown, stiff, with manganese oxide veins and calcareous zones.	23	20/40 silica sand
23				0								-CL- SILTY CLAY: Light brown and yellowish brown, medium stiff to stiff, with trace calcareous material and trace manganese oxide staining.	25	
25														

<b>Sampler Types:</b> <input checked="" type="checkbox"/> Split Spoon <input checked="" type="checkbox"/> Shelby <input checked="" type="checkbox"/> Bulk Sample <input checked="" type="checkbox"/> Grab Sample <input type="checkbox"/> Penetrometer <input type="checkbox"/> Vane Shear <input type="checkbox"/> California <input type="checkbox"/> Sonic	<b>Operation Types:</b> <input type="checkbox"/> Mud Rotary <input type="checkbox"/> Continuous Flight Auger <input type="checkbox"/> Wash Rotary <input type="checkbox"/> Auger <input type="checkbox"/> Air Rotary <input type="checkbox"/> Core Barrel <input type="checkbox"/> Drive Casing	<b>Notes:</b> Bottom of borehole at 25.0 feet.
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Logger: Christian M. Liul

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear



Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: VCM Area

Surface Elevation: 19.65

Borehole Number: P-66

Borehole  
Diameter (in.):

Date Started: 6/20/2013

Date Finished: 6/20/2013

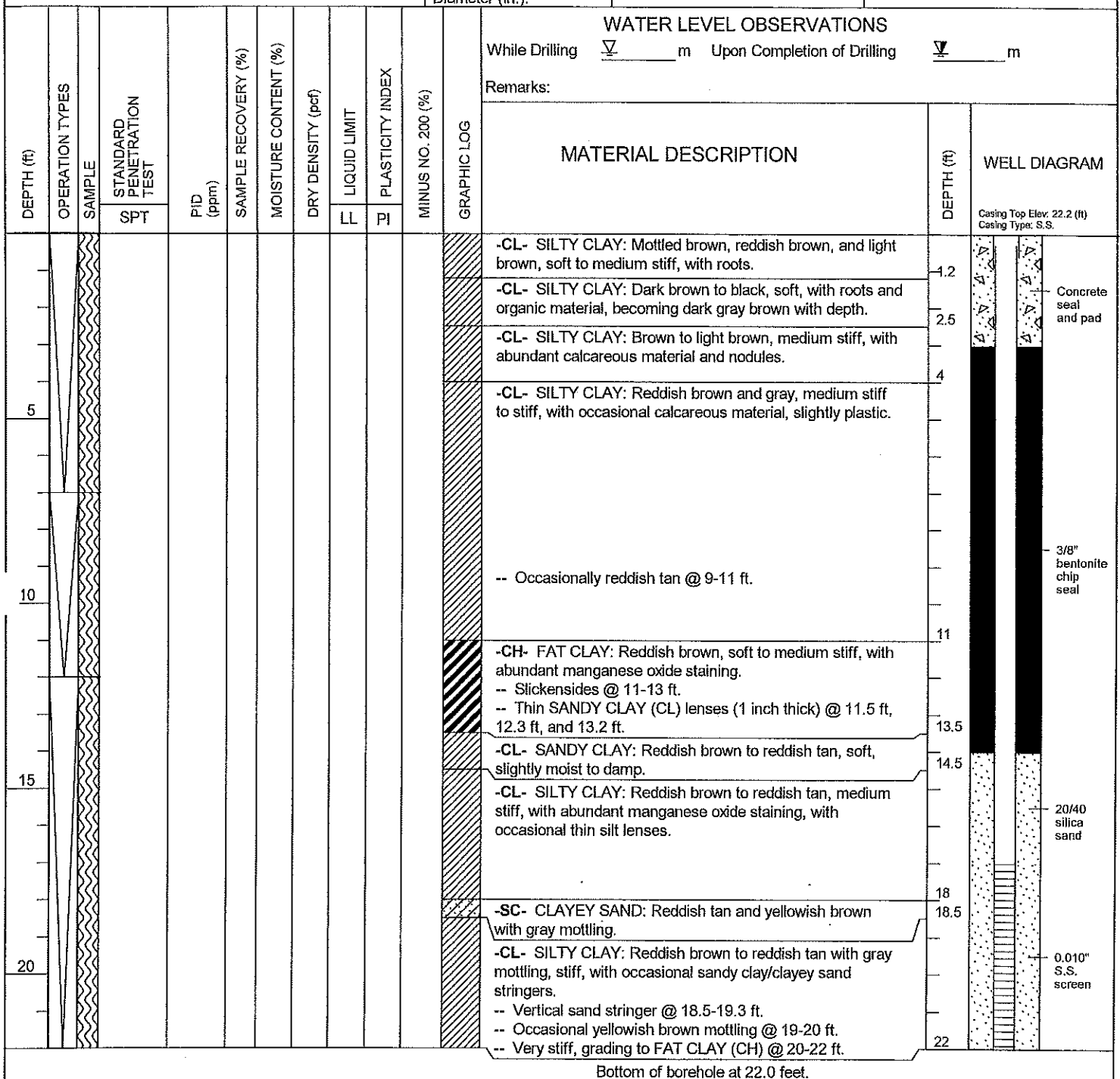
## WATER LEVEL OBSERVATIONS

While Drilling  $\nabla$  m Upon Completion of Drilling  $\nabla$  m

Remarks:

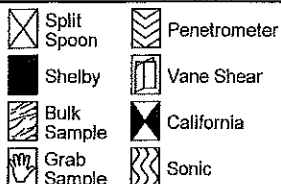
## MATERIAL DESCRIPTION

## WELL DIAGRAM

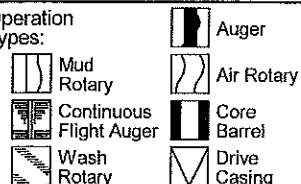
Casing Top Elev. 22.2 (ft)  
Casing Type: S.S.

Bottom of borehole at 22.0 feet.

## Sampler Types:



## Operation Types:



Notes:

Logger: Christian M. Llull

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear



TETRA TECH

## LOG OF BORING P-68

Page  
1 of 1

Project Name: FPC-TX SUPPLEMENTAL AOC CHARACTERIZATION

Borehole Location: Former WWTP

Surface Elevation: 19.64

Borehole Number: P-68

Borehole  
Diameter (in.):

Date Started: 6/14/2013

Date Finished: 6/14/2013

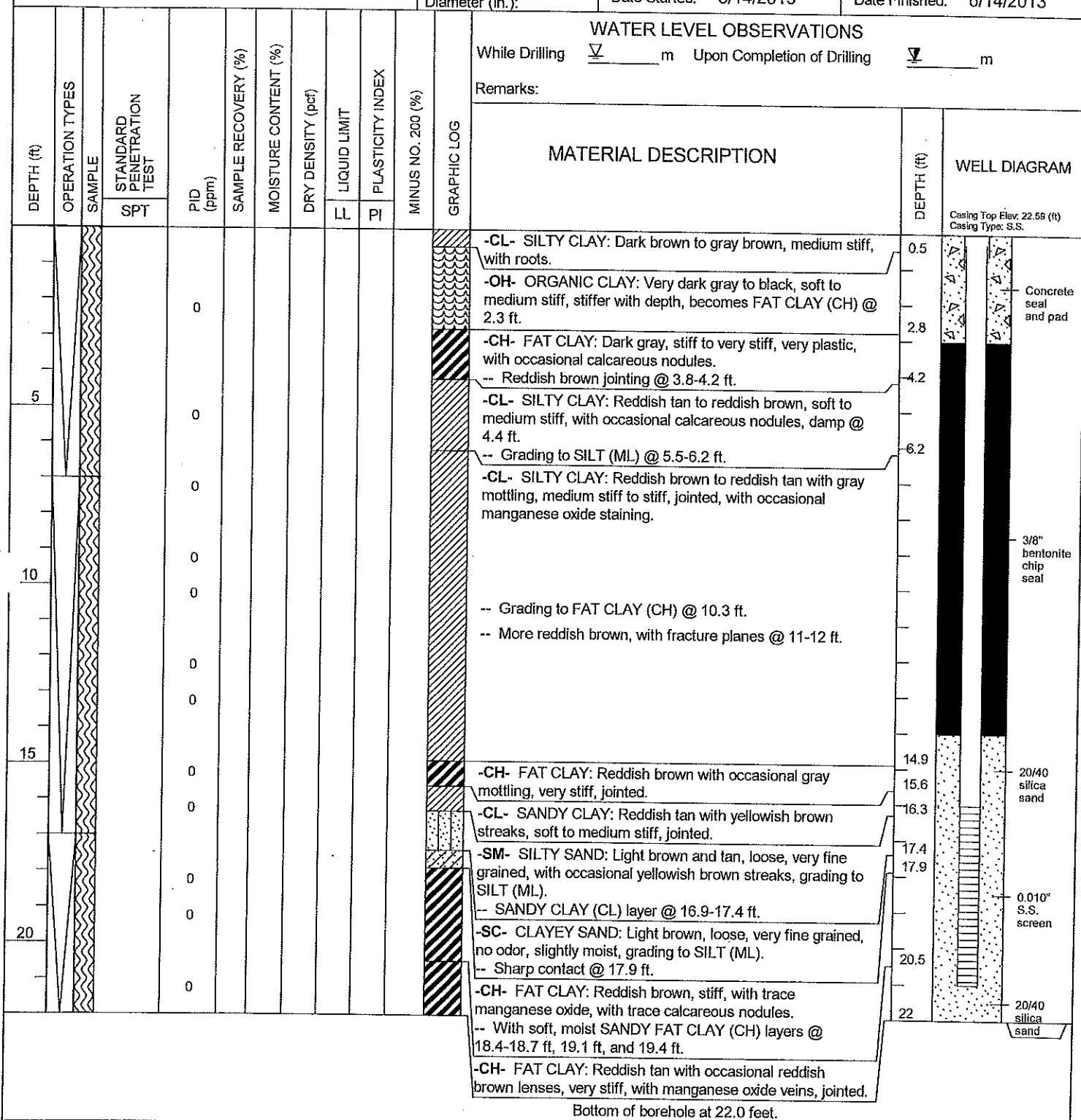
## WATER LEVEL OBSERVATIONS

While Drilling  $\nabla$  m Upon Completion of Drilling  $\nabla$  m

Remarks:

## MATERIAL DESCRIPTION

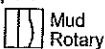
## WELL DIAGRAM



Sampler Types:



Operation Types:



Notes:

Logger: Christian M. Liul

Drilling Equipment: Sonic Rig 128

Contractor: Boart Longyear